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THE STORY OF THE INDIC COSMOLOGY AND THE CELESTIAL TIME KEEPERS

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CHAPTER I INTRODUCTION

In order to understand the Indic approach to history, one must understand the cosmology and the calendar of the Hindu. The calendar and the cosmos have always played a large part in the consciousness or weltanschuung of the Hindu and he spent a large portion of his observational powers in deciphering the universe around him. In this he was not alone, as we know now that other ancient civilizations, such as the Babylonian, the Egyptian and the Chinese had similar interests and a curiosity about the heavens. But the answers the Indic came up with were quite prescient for his time and the resulting numbers were far more accurate than the European world realized or knew, even millennia after the Indic discovered these periodicities. The extraordinary allergy that the Occidentals, with a few notable exceptions, have exhibited to the study of the Indic mathematical tradition, and when they have done so, the vehemence with which they have denied the autochthonous origin of the Indic intellectual traditions, is astonishing to say the least. The consistency with which the Occidental denied the Indic contributions is exemplified in the writings of various Indologists such as Whitney[1], Bentley[2], Moriz Winternitz[3] Albrecht Weber[4], W W Rouse Ball, G R Kaye, Thibaut and continues on till today in the works of David Pingree . As we have emphasized, there were exceptions such as Brennand, Playfair, Colebrooke, and Bailly.

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[1] American Indologist. One of Salisbury's students at Yale, William Dwight Whitney (1827-1901) went on to become a distinguished Sanskritist in his own right having studied in Berlin under German scholars as Bopp and Weber. But like Weber became one of the principal detractors of the notion that anything worthwhile came out of India especially in the field of Astronomy. Whitney became a full professor of Sanskrit language and literature at Yale in 1854, wrote his classic *Sanskrit Grammar* (1879) and was the doyen of Indologists of his period. Like many who considered themselves expert in Sanskrit, it is doubtful he ever chanted a single sloka in his life. American Indologists have generally toed the line that Whitney first pursued and have not deviated from the Eureocentric , presumably because racial considerations predominated above all else. One wonders why in the face of such contempt for a people , these gentleman continued to study their heritage. The answer lies in their assumption that Sanskrit was not autochthonous to the subcontinent but was brought into India by the mythical indo European or as they were known then by the name Aryans. They not only appropriated the Sanskrit heritage as their own but denied that it was native to the geography of the Indian subcontinent. This is a direct consequence of the loss of control of their own historical narrative. No civilization or peoples can afford this luxury, if they wish to retain the authentic narrative of their own heritage See also Whitney (1874) and Whitney (1895)

[2] "John Bentley: Hindu Astronomy, republished by Shri Publ., Delhi 1990, p.xxvii;" By his [Playfair's] attempt to uphold the antiquity of Hindu books against absolute facts, he thereby supports all those horrid abuses and impositions found in them, under the pretended sanction of antiquity. Nay, his aim goes still deeper, for by the same means he endeavors to overturn the Mosaic account, and sap the very foundation of our religion: for if we are to believe in the antiquity of Hindu books, as he would wish us, then the Mosaic account is all a fable, or a fiction." So this is the argument that prevailed. Hindu astronomy could not be believed not because it was flawed, but that it would overturn the orthodoxy of the Christian church. So much for the scientific temper of western scholarship and their much vaunted blather about the importance that they attached to the scientific approach and the love of proof they inherited from the Greeks. In doing so, the Occidental chose to abandon all pretence of scholarship and with few exceptions preferred to succumb to their own prejudices

[3] In 1925 The Professor of Indian Studies at the German University of Prague, Moriz Winternitz (1863-1937), denounced Schopenhauer for his admiration of the Upanishads with the following words - 'Yet I believe, it is a wild exaggeration when Schopenhauer says that the teaching of the Upanishads represents 'the fruit of the highest human knowledge and wisdom' and contains 'almost superhuman conceptions the originators of which can hardly be regarded as mere mortals...' On the subject of the Vedas, Winternitz had this to say -'It is true, the authors of these hymns rise but extremely seldom to the exalted flights and deep fervor of, say, religious poetry of the Hebrews.' Not even scholars seem to be immune to the quality of lack of graciousness when it comes to recognition of the work of other cultures and civilizations that seems to pervade the Occident.

[4] The famous German indologist Albrecht Weber (1825-1901) was a notorious racist whose German nationalistic tendencies were thinly veiled as works on Indian philosophy and culture. When Humbolt lauded praise upon the *Bhagavad-gita*, Weber became disgusted. His immediate response was to speculate that the *Mahabharata* and *Gita* were influenced by Christian theology -*'The peculiar coloring of the Krishna sect, which pervades the whole book, is noteworthy: Christian legendry matter and other Western influences are unmistakably present...'*

TH RELUCTANCE OF INDOLOGISTS IN THE OCCIDENT TO ACKNOWLEDGE THE VEDIC EPISTEME

The resulting illiteracy on the part of the western scholar on matters pertaining to India was lethal to the understanding of their own history and leaves Occidental historians, the task of explaining why there was no progress in Europe between the time of the Greek contribution to the mathematical sciences and the flowering of the renaissance resulting in the Keplerian paradigm shift, a period exceeding 1600 years. We are compelled to remark that the sudden explosion of knowledge that took place during the renaissance, occurred shortly after the Jesuits sent 70 scholars to Malabar in the 1500's . When it came to reconciling himself with the obvious depth of knowledge of the ancient indic ,the occidental had no hesitation in coming to the conclusion that the Indic had borrowed everything form Greece. But he is more than reluctant to accept that a massive transfer of knowledge took place from India to Europe, even though the evidence is far more compelling The conventional wisdom in the West was that the Jesuits were sent to convert the Indics to the Christian faith and as a byproduct teach them the finer points of the occidental civilization. In reality it turns out, they were sent to learn a whole host of topics such as navigation, mathematical techniques including trigonometry, and the Indian approach to calendrical astronomy. In short the Jesuits embarked on a systematic study of the Indic episteme, since it was obvious that the Indics had made considerable advances, which the Jesuits were quick to realize were far advance of their own that . We are in the process of chronicling the study of those individuals who in turn studied India or studied subjects in which the Indics had great proficiency, beginning with ancient Babylon to the British , to understand the role that India and the Indic episteme played in the renaissance of Europe. While there is nothing here that can be considered to be morally reprehensible , one wonders why there was the extreme reluctance to admit that they learned from others too. In this one has to concede that the scholar during the heyday of Islam observed a higher degree of ethics than his brethren in the Occident, because he never exhibited the slightest hesitation in attributing to the Indic the episteme that he had learned from him

We view the study of history and philosophy of science as central to the understanding of any civilization and its ethos. And hence we make no apology for the emphasis on science, and especially on Astronomy in our study of history.
The Ancient Vedics seemed to have an obsession for precision as well as a fascination for large numbers. They also subscribed to the notion that the planet earth and the solar system were of immense antiquity without a beginning, in contrast to the creationist theories propounded by many in the west till recently. A combination such as this makes an excellent prerequisite for time keeping and for devising a useful and practical calendar. So, they turned to the sky and began to decipher the meaning behind the various cycles and periodicities that they observed, in order to help them plan their activities, such as the planting of their crops Let us see how they went about developing a calendar that would convey a lot of information merely by knowing the day of the month, after constant observation of the sky both during the day and the night over centuries. The result was a highly efficient and accurate calendar. The added bonus of such a system is the usefulness of the recordings of ancient astronomy to decipher the age at which various events took place, and the development of methods now known collectively as Archaeo-astronomy.
The basic information they used for purposes of time keeping were the motions of the sun and the moon relative to the earth. So far nothing unusual, as did all the other ancients. The cycles they used including the day, the week, the fortnight, and the month are shown in Table 1.

TABLE 1[5]

60 ghatikas (or 30 muhurtas or 8 praharas) in a 24-hour period (ahoratra)
15 tithi in a paksha or a fortnight, 15th is Poornima or amavasya
The Lunar Month (2 pakshahs in a month), shukla waxing and krishna waning
The Sidereal Year(Nirayana) , the Tropical Year,the Anomalistic Year
The six seasons of a year (each season comprises 60 days)
60 year Jovian cycle/ 360 year 'divine cycle
2700 year cycle of the Sapta Rishi or the Ursa Major
26000 yer cycle of the asterisms called the Great Year or the precession cycle
432,000 year cycle called a yuga (= duration of Kaliyuga)
4,320,000 year cycle known as the Maha Yuga
Kalpa, the cycle consisting of 4.32*10**9 years

We will give a brief history of Indic astronomy in the next chapter, to put the astronomical discoveries in the proper context within the larger canvas of Indic history. Contrary to the conventional wisdom of occidental versions of the Indic narrative, India had a very strong and consistent tradition of scholarship in the so called exact sciences of antiquity (as Neugebauer called them) such as astronomy and mathematics. The list of famous astronomers and mathematicians is staggering both in the quantity, in the quality of the contributions, as well as the time span over which it occurred. We list in Table 14 significant contributers in the appendix. This was certainly a revelation for me.

INDIAN COSMOLOGY AND TIMELINES OF HISTORY

There are some who feel that the reference to a Mahayuga going back to 4,320,000 years, is without foundation, since we do not have recorded history going back that far and the more appropriate measure to us is the divine year. There is a suspicion that somewhere along the historical past, there was confusion in the interpretation of the various definitions of the year, which has resulted in such long periods being assigned to the Yugas such as Kaliyuga. We will discuss later the relevance of the divine year which is mentioned as being comprised of 360 tropical years. For example the duration of a Kaliyuga in Divine years is a more manageable 1200 years and the entire Mahayuga is 12000 years which is of the same time scale as the beginning of river valley civilizations, if we assume that there was a confusion regarding the interpretation of the year. We will discuss this later. It is the attempt of the ancient Indic to describe geologic time scales associated wth the beginning of recorded hstory that causes confusion and has invited the ridicule of some in the occident such as Thomas Babingtin Macaulay and has prompted him to chatracterize the entire literature of India as being worthless

THE CELESTIAL SPHERE

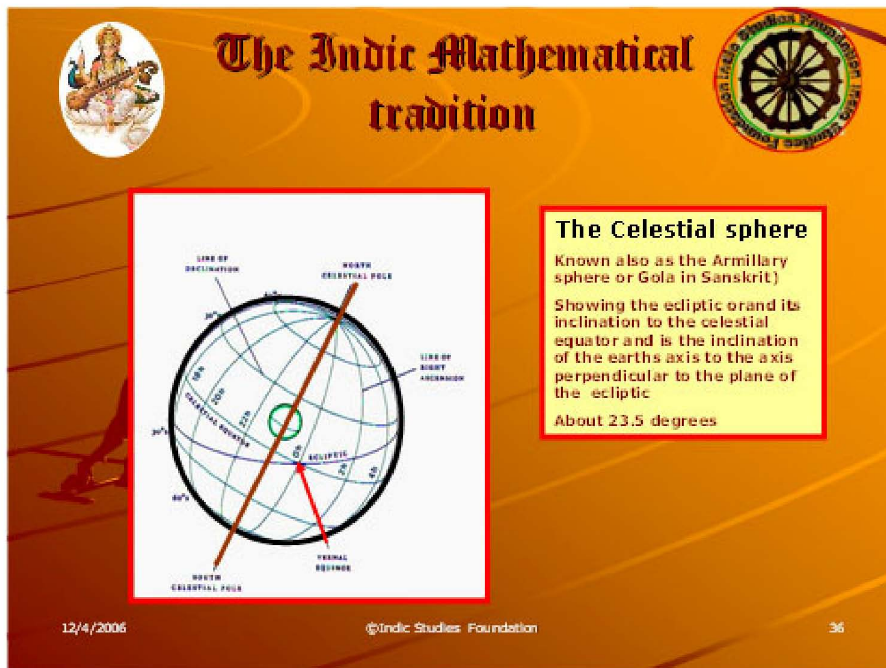
It is conceptually useful to visualize the sky as the interior of a vast celestial sphere, but before we do so , let us recap the

[5] Suryasiddhanta

essential features of the Terrestrial sphere. The earth is generally represented as a perfect sphere. Although in reality it is an oblate spheroid (ellipsoid), with a larger diameter at the equator equal to 7,926.41 miles (12,756.32 kilometers). The diameter of the great circle passing hrough the north and the south pole is slightly less and is equal to 7,901 miles (12,715.43 km) , the difference amounting to .32 %. To specify the location of a particulat point on the surface of the earth , we use the measures of longitude and the latitude. The longitude is the angle subtended by the arc of a great circle from the equator to the point. The latitude is is the abgle subtended by the arc of the equator fom the point to the projection of Greenwich, UK on the great circle. Both these quantities are measured in degrees. The great circle passing tough Greewnich is known as the prime meridian.

Every day the celestial sphere, (the interior of a vast sphere centered in the earth) appears to turn in the opposite direction as the earth rotates, causing the daily rising and setting of the sun, stars and other celestial objects (Figure 1). We know now that the sky and the objects in the sky do not rotate (at least not with respect to the earth), but it is an extremely useful construct that serves our purpose of describing the sky and locate the planets and the stars. The Celestial sphere is a vast imaginary sphere with the earth as its center that appears to rotate from East to West.

Figure 1



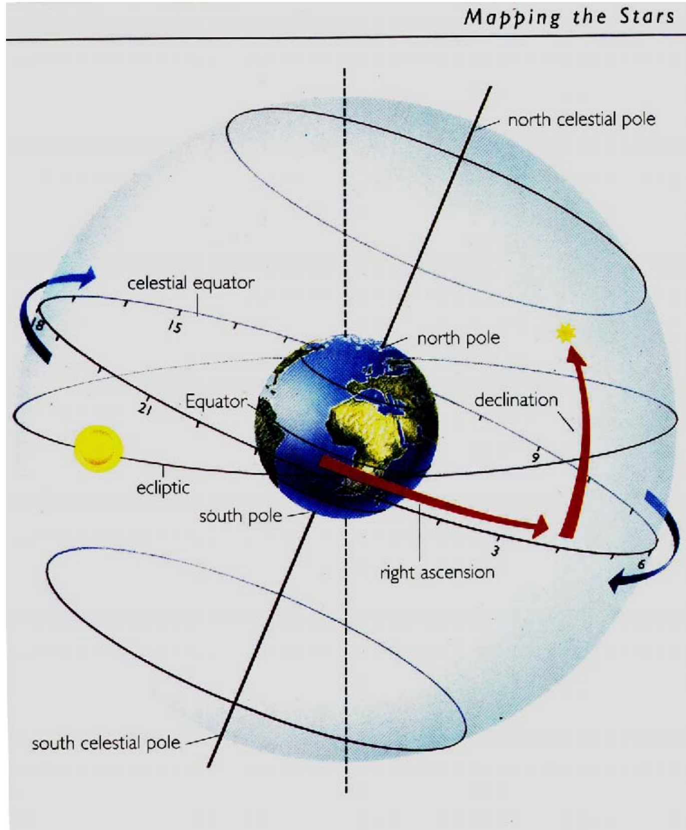


Figure 2. The celestial sphere showing the ecliptic and its inclination to the celestial equator

ECLIPTIC क्रांतिवृत (KRANTHIVRUTH)

(ēklĬp´tĬk, Ĭ-), the great circle on the celestial sphere that lies in the plane of the earth's orbit (called the plane of the ecliptic). Because of the earth's yearly revolution around the sun, the sun appears to move in an annual journey through the heavens with the ecliptic as its path. The ecliptic is the principal axis in the equatorial coordinate system. The two points at which the ecliptic crosses the celestial equator are the equinoxes. The obliquity of the ecliptic is the inclination of the plane of the ecliptic to the plane of the celestial equator, an angle of about 23 1/2 °. The constellations through which the ecliptic passes are the constellations of the Zodiac (Rasi).

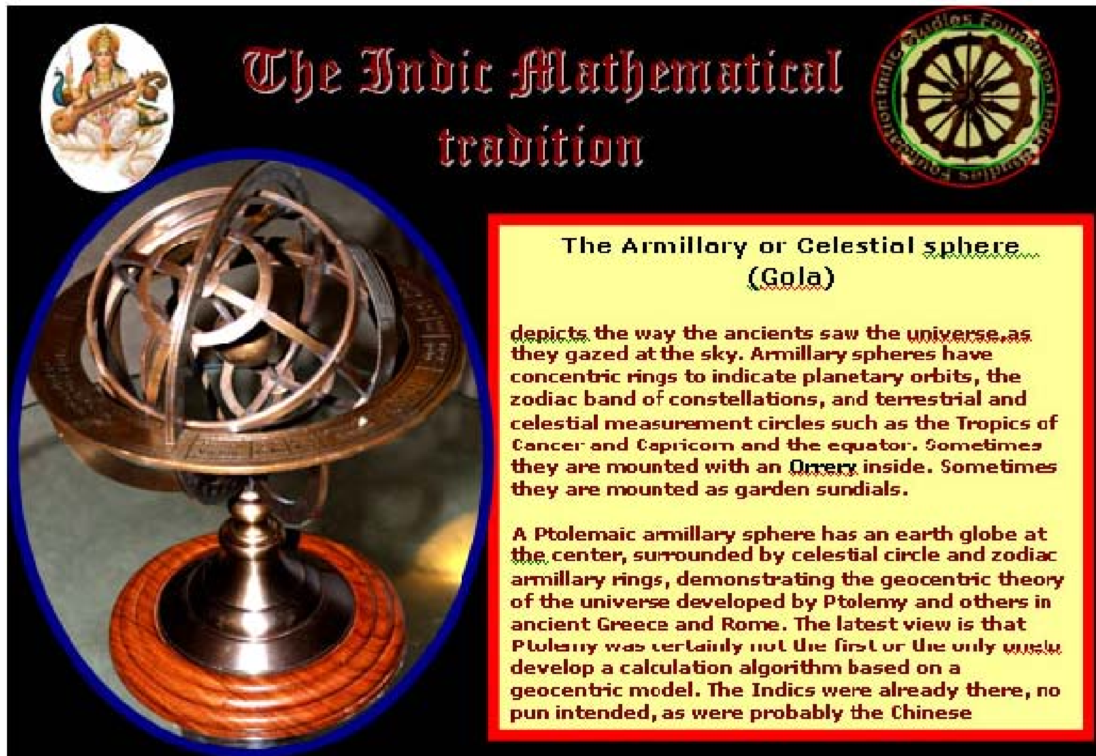


Figure 3. The Ptolemaic Armillary sphere

The Armillary sphere was also the model used by the Indics, even though Aryabhata was aware that the earth was spinning on its axis and that it was a heliocentric system where the earth was merely a planet. Even today, we use a coordinate system that is geocentric while observing the planets and the rest of the solar system, simply because that is the easiest way to study the sky.

THE COORDINATES OF THE CELESTIAL SPHERE

Let us establish the coordinate systems. The axis of the earth, about which it is spinning, is tilted to the plane of rotation (ecliptic) by about 23 degrees). Our location on Earth is expressed through our latitude (north-south position; see above) and *longitude*, which gives your east-west position. Similarly we locate a star in the celestial sphere by the terms **Right Ascension (RA)**, which is analogous to longitude and **Declination (DEC**), which is analogous to latitude

Draw a circle called a *meridian* from the North Pole through the location to the South Pole, then do the same through Greenwich, England to define the ***Prime Meridian***, and note where they cross the equator.

FIGURE 4 AND 5 THE CELESTIAL SPHERE INDICATING THE SOLSTICES AND THE EQUINOXES

However, RA differs from longitude in essential ways. RA is measured always from the first point of Aries or Mesha as opposed to longitude which is measured from Greenwich, England, and the units are always measured in hours,

minutes and seconds rather than degrees, minutes and seconds.

In astronomy, the **hour angle** of an object relative to a particular location is one of the coordinates used in the equatorial coordinate system for describing the position of an object on the celestial sphere. The hour angle of a point is the angle between the half plane determined by the Earth axis and the zenith (half of the meridian plane) and the half plane determined by the Earth axis and the given location. The angle is taken with minus sign if the location is eastward of the meridian plane and with the plus sign if it is westward of the meridian plane. The hour angle is usually expressed in time units, with 24 hours corresponding to 360 degrees. The hour angle must be paired with the declination in order to fully specify the position of an object on the celestial sphere as seen by the observer at a given time.

Relation with the right ascension

The hour angle (HA) of an object is equal to the difference between the current local sidereal time (LST) and the right ascension (RA) of that object:

$HA_{object} = LST - RA_{object}$

Thus, the object's hour angle indicates how much sidereal time has passed since the object was on the local meridian. It is also the angular distance between the object and the meridian, measured in hours (1 hour = 15 degrees). For example, if an object has an hour angle of 2.5 hours, it transited across the local meridian 2.5 sidereal hours ago (i.e., hours measured using *sidereal time*), and is currently 37.5 degrees west of the meridian. Negative hour angles indicate the time until the next transit across the local meridian. Of course, an hour angle of zero means the object is currently on the local meridian.

The Local Celestial Meridian is the great circle that passes through the North Celestial Pole and a particular location.

Thus, the angular displacement of a star to the **west** of the celestial meridian (as measured along the celestial equator, analogous to longitude) is equal the ***HA,*** which is usually given in time units at a rate of 15° per hour. *Apparent solar time* is given by the hour angle of the Sun plus 12 hours (the 12 hours added so that the "day" starts at midnight). Because of the eccentricity of the Earth's orbit and the obliquity of the ecliptic, apparent solar time does not keep a constant pace. Corrections for their effects lead to constant *mean solar time*, which can differ from apparent solar time by up to 17 minutes. The hour angle of the Sun, and therefore the time of day, varies continuously with longitude, wherein longitude differences exactly equal time differences. *Standard times* are the mean solar times of the closest standard meridians, which are displaced in units if 15° from Greenwich. (Political boundaries cause variances.)

Star time, properly called *sidereal time*, is the hour angle of the Vernal or Spring Equinox. Because the Sun moves to the east along the ecliptic, the Sun takes longer to make a circuit of the sky on its daily path than does a star or the equinox, so the solar day is 4 minutes longer than the sidereal day. As a result, the sidereal clock gains 4 minutes (actually 3 minutes 56 seconds) per day over the solar clock, starting from the time of solar passage across the autumnal equinox on September 23, when the two are the same.

To repeat, the RA of a star or any other celestial body (given by the lower-case Greek letter alpha) is the angle the body makes with the vernal equinox as measured to the east, again along the celestial equator. It too is usually measured in time units. The right ascension and hour angle of a body always add to equal the sidereal time. Given the sidereal time and the right ascension of a body, you can compute its hour angle, which with the declination allows you to set a telescope and to find anything

EQUINOX वसंत संपत (VASANTH SAMPAT) VERNAL EQUINOX

(ē´kwĬnŏks), either of two points on the celestial sphere where the ecliptic and the celestial equator intersect. The vernal equinox, also known as “the first point of Aries,” is the point at which the sun appears to cross the **celestial equator** from south to north. This occurs about Mar. 21, marking the beginning of spring in the Northern Hemisphere. At the autumnal equinox, about Sept. 23, the sun again appears to cross the celestial equator, this time from north to south; this marks the beginning of autumn in the Northern Hemisphere. On the date of either equinox, night and day are of equal length (12 hours each) in all parts of the world; the word equinox is often used to refer to either of these dates.

Thus the equinoxes are not fixed points on the celestial sphere but move westward along the ecliptic, passing through all the constellations of the zodiac in 26,000 years. This motion is called the precession of the equinoxes. The vernal equinox is a reference point in the equatorial coordinate system.

SOLSTICE

SUMMER SOLSTICE: The first day of the Season of Summer. On this day (JUNE 21 in the northern hemisphere*) the Sun is farthest north and the length of time between Sunrise and Sunset is the longest of the year.

WINTER SOLSTICE: The first day of the Season of Winter. On this day (DECEMBER 22 in the northern hemisphere*) the Sun is farthest south and the length of time between Sunrise and Sunset is the shortest of the year.

*** *In the southern hemisphere, winter and summer solstices are exchanged. Summer: December 22. Winter: June 21.***

PRECESSION OF THE EQUINOXES

The earth revolves around the Sun once in 365 days 5 hours 48 minutes and 46 seconds. Considered from the earth, the Sun appears to complete one round of the ecliptic during this period. This is called a tropical year .In the span of a tropical year; the earth regains its original angular position with the Sun. It is also called the year of seasons, since the seasons depend on this Earth-Sun cycle. If we consider the revolution of the Sun around the earth from one vernal equinox (around 21st March, when the day and night all over the globe are equal) to the next vernal equinox, it takes one tropical year to do so. However, if at the end of a tropical year from one vernal equinox to the next, we consider the position of the earth with reference to a fixed star of the zodiac, the earth appears to lie some 50.26 seconds of celestial longitude to the west of its original position. In order for the earth to attain the same position with respect to a fixed star after one revolution, it takes a time span of 365 days 6 hours 9 minutes and some 9.5 seconds. This duration of time is called a sidereal year .The sidereal year is just over 20 minutes longer than the tropical year. Each year, the Vernal equinox will fall short by 50.26 seconds along the zodiac reckoned along the fixed stars. This continuous receding of the Vernal equinox along the zodiac is called the Precession of the equinoxes.

UTC date and time of solstices and equinoxes[1]

year	Equinox Mar		Solstice June		Equinox Sept		Solstice Dec	
	day	time	day	time	day	time	day	time
2002	20	19:16	21	13:24	23	04:55	22	01:14
2003	21	01:00	21	19:10	23	10:47	22	07:04
2004	20	06:49	21	00:57	22	16:30	21	12:42
2005	20	12:33	21	06:46	22	22:23	21	18:35
2006	20	18:26	21	12:26	23	04:03	22	00:22
2007	21	00:07	21	18:06	23	09:51	22	06:08
2008	20	05:48	20	23:59	22	15:44	21	12:04
2009	20	11:44	21	05:45	22	21:18	21	17:47
2010	20	17:32	21	11:28	23	03:09	21	23:38
2011	20	23:21	21	17:16	23	09:04	22	05:30
2012	20	05:14	20	23:09	22	14:49	21	11:11
2013	20	11:02	21	05:04	22	20:44	21	17:11
2014	20	16:57	21	10:51	23	02:29	21	23:03

TABLE 2

The day and time of the solstices and equinoxes

SOLSTICE

A solstice is an astronomical event that happens twice a year, when the tilt of the Earth's axis is most oriented toward or away from the Sun, causing the Sun to reach its northernmost or southernmost extreme. The name is derived from the Latin *sol* (sun) and *sistere* (to stand still), because at the solstices, the Sun stands still in declination; that is, it's apparent movement north or south comes to a standstill. The Summer Solstice falls between June 20 and 23 of every year in the northern hemisphere and has different significance for various religions.[2]

The term *solstice* can also be used in a wider sense, as the date (day) that such a passage happens. The solstices, together with the equinoxes, are connected with the seasons. In some languages they are considered to start or separate the seasons; in others they are considered to be centre points.

SYNOPSIS OF EQUATORIAL COORDINATE SYSTEM

In summary, the most commonly used astronomical coordinate system for indicating the positions of stars or other celestial objects on the celestial sphere are the Equatorial coordinate system. The celestial sphere is an imaginary sphere with the observer at its center. It represents the entire sky; all celestial objects other than the earth are imagined as being located on its inside surface. If the earth's axis is extended, the points where it intersects the celestial sphere are called the celestial poles; the north celestial pole is directly above the earth's North Pole, and the south celestial pole directly above the earth's South Pole. The great circle on the celestial sphere halfway between the celestial poles is called the celestial equator; it can be thought of as the earth's equator projected onto the celestial sphere. It divides the celestial sphere into the northern and southern skies. An important reference point on the celestial equator is the vernal equinox, the point at which the sun crosses the celestial equator in March. To designate the position of a star, the astronomer considers an imaginary great circle passing through the celestial poles and through the star in question. This is the star's hour circle, analogous to a meridian of longitude on earth. The astronomer then measures the angle between the vernal equinox and the point where the hour circle intersects the celestial equator. This angle is called the star's right ascension and is measured in hours, minutes, and seconds rather than in the more familiar degrees, minutes, and seconds. (There are 360 degrees or 24 hours in a full circle.) The right ascension is always measured eastward from the vernal equinox. Next the observer measures along the star's hour circle the angle between the celestial equator and the position of the star. This angle is called the declination of the star and is measured in degrees, minutes, and seconds north or south of the celestial equator, analogous to latitude on the earth. Right ascension and declination together determine the location of a star on the celestial sphere. The right ascensions and declinations of many stars are listed in various reference tables published for astronomers and navigators. Because a star's position may change slightly (see proper motion and precession of the equinoxes), such tables must be revised at regular intervals. By definition, the vernal equinox is located at right ascension 0 h and declination 0°.
Another useful reference point is the sigma point, the point where the observer's celestial meridian intersects the celestial equator. The right ascension of the sigma point is equal to the observer's local sidereal time. The angular distance from the sigma point to a star's hour circle is called its hour angle; it is equal to the star's right ascension minus the local sidereal time. Because the vernal equinox is not always visible in the night sky (especially in the spring), whereas the sigma point is always visible, the hour angle is used in actually locating a body in the sky.

The Indian calendrical system is based on sidereal measurements. In order to understand the system we need to review some definitions of the year, month and the day.

THE YEAR

A *solar year* and a *sidereal year* both refer to the amount of time it takes Earth to revolve about the Sun. The difference between the two measures is in the reference point for one revolution. The Latin root of *sidereal* is *sidereus,* “starry,” which itself comes from *sides,* “star, installation.” The Latin root of *solar* is *solis,* “sun.” Thus, the difference between a solar year and a sidereal year is the difference in time between one complete revolution of Earth relative to the Sun, and one complete revolution of the earth relative to the constellations respectively.

A **tropical year** (also known as a **solar year**) is the length of time the Sun, as seen from the Earth, takes to return to the same position along the ecliptic (its path among the stars on the celestial sphere) relative to the equinoxes and solstices, or the time interval needed for the mean tropical longitude of the Sun to increase by 2π (360 sexagesimal degrees, a complete turn). The length of time depends on the starting point on the ecliptic. Starting from the (northern) vernal equinox, one of the four cardinal points along the ecliptic, yields the **vernal equinox year**; averaging over all starting

points on the ecliptic yields the **mean tropical year**.

A **calendar year** is the time between two dates with the same name in a calendar. Then there is the , **anomalistic year**, which is the time it takes for one rotation around the sun as measured from perigee to perigee (see glossary).The **anomalistic year** is the time taken for the Earth to complete one revolution with respect to its apsides. The orbit of the Earth is elliptical; the extreme points, called apsides, are the perihelion (when the perigee refers to planetary motion) , where the Earth is closest to the Sun (January 3 in 2008), and the aphelion, where the Earth is farthest from the Sun (July 4 in 2008). The anomalistic year is usually defined as the time between two successive perihelion passages. Its average duration is:
365.259 635 864 days (365 d 6 h 13 min 52 s) (at the epoch 2000.0).

The anomalistic year is slightly longer than the sidereal year because of the precession of the apsides (or anomalistic precession).

The Gregorian calendar attempts to keep the vernal equinox on or soon before March 21; hence it follows the vernal equinox year. The average length of this calendar's year is 365.2425 mean solar days (which can be thought of as 97 out of 400 years being leap years) whereas the vernal equinox year is 365.2424 days.
On the Earth, the tropical year is shorter than a sidereal year. This difference was, in AD 1900, equal to 20.400 min, and in AD 2000, 20.409 minutes, and seems to slow the Sun from south to north and back. The word "tropical" comes from the Greek *tropos* meaning "turn". The tropics of Cancer and Capricorn mark the extreme north and south latitudes where the Sun can appear directly overhead. The position of the Sun can be measured by the variation from day to day of the length of the shadow at noon of a gnomon (a vertical pillar or stick). This is the most "natural"way to measure the year in the sense that these variations drive the seasons.

TABLE 3 DIFFERENCE BETWEEN THE SIDEREAL AND TROPICAL YEAR[6]

Type of Year	Days
Sidereal Year	365.256363 (2007)
Tropical Year	365.242190 (2007)

The **sidereal year (Nirayana)** is the time taken for the Sun to return to the same position with respect to the stars of the celestial sphere. It is the orbital period of Earth, equal to 365.256363 mean solar days (31,558,149.760 seconds), that is 366.256363 earth rotations or sidereal days. (A true cycle will always compare two objects that differ mathematically by exactly 1). The sidereal year is 20 minutes and 24 seconds longer than the tropical year. The Sun and the stars cannot be seen at the same time; if one looks every dawn at the eastern sky, the last stars seen appearing are not always the same. In a week or two an upward shift can be noted. As an example, in July in the Northern Hemisphere, Orion cannot be seen in the dawn sky, but in August it becomes visible. In a year, all the constellations rotate through the entire sky.
If one looks regularly at the sky before dawn, this motion is much more noticeable and easier to measure than the north/south shift of the sunrise point in the horizon, which defines the tropical year on which the Gregorian calendar is based. This is the reason many cultures started their year on the first day a particular special star, (Sirius, for instance), could be seen in the East at dawn. In Hesiod's Works and Days, the times of the year for sowing, harvest, and so on are given by reference to the first visibility of stars.

[6] The Indian Astronomical Ephemeris for the year 2007, Positional Astronomy Centre, India Meteorological Department, Kolkatta, India

Up to the time of Hipparchus, at least in Europe, the years measured by the stars were thought to be exactly as long as the tropical years. Even then, in fact until the16th century they had no accurate sidereal measurements. In fact, sidereal years are very slightly longer than tropical years. The difference is caused by the precession of the equinoxes. One sidereal year is roughly equal to 1 + 1/25600 or 1.00003906 tropical years.
But until 1540 CE, when the Society of Jesus sent a whole slew of Jesuits trained to absorb such knowledge, in order that they may learn the science of the calendar and of navigation from the Namboodri (etymology nama putri) Brahmanas of Kerala, there was a lack of knowledge of subjects like navigation. Prior to this date the Portuguese who were the most advanced in these matters, only sailed during the night, when they had the visible stars to guide them. An average voyage to India took them 2 years from Lisbon. With the knowledge so gained they fixed the Gregorian calendar which was always error prone.
Julian Year - In astronomy, a Julian year (symbol: a) is a unit of measurement of time defined as exactly 365.25 days of 86,400 SI seconds each, totaling 31,557,600 seconds. That is the average length of the year in the Julian calendar used in Western societies in previous centuries, and for which the unit is named. Nevertheless, because a Julian year measures duration rather than designates date, the Julian year does not correspond to years in the Julian calendar or any other calendar. Nor does it correspond to the many other ways of defining a year .
Like most Asian calendars Indian calendars do not employ solely the solar year and day (i. e. tropical year and solar day) but the sidereal year, and the Synodic month (29.5306 days). Thus, the calendrical year based on the sidereal year is defined as the time between two successive passes of the sun through a certain star's circle of declination. Lunar days and sidereal months are also used, and in certain lunisolar calendars lunar year and lunar month are taken into account, too.
The Astronomical knowledge of Ancient India was written down in scientific treatises, called Siddhantas. In them, values for the lengths of months and years were given representing the latest knowledge at the time the Siddhanta was written. The values range from 365.258681 days in the Âryabhatiya to 365.258756 days in the Surya Siddhanta and are all too long compared with the modern sidereal year length of 365.25636 days. Nevertheless they are still in use in Indian calendars today.

HINDU CALENDAR - YEAR NUMBERING

The epoch (starting point or first day of the first year) of the current era of Hindu calendar (both solar and lunisolar) is BCE 3102 January 23 on the proleptic Gregorian calendar (i.e. the Gregorian calendar extended back in time before its promulgation from 1582 October 15). Both the solar and lunisolar calendars started on this date. After that, each year is labeled by the number of years **elapsed** since the epoch.

This is a unique feature of the Hindu calendar. All other systems use the current ordinal number of the year as the year label. But just as a person's true age is measured by the number of years that have elapsed starting from the date of the person's birth, the Hindu calendar measures the number of years elapsed. Today (as of writing this on 2005-05-18) the elapsed years in the Hindu calendar are 5106 and this is the 5107th Hindu calendar year. Note that the lunisolar calendar year will usually start earlier than the solar calendar year.

Other systems of numbering the Hindu years were prevalent also.

TABLE 4 SUMMARY OF VARIOUS MEASURES OF A YEAR

Summary of various designations of a year
353, 354 or 355 days — the lengths of common years in some lunisolar calendars.
354.37 days (12 lunar months) — the average length of a year in lunar calendars.29.53
365 days — a common year in many solar calendars.

365.24219 days — a mean tropical year near the year 2000.
365.2424 days — a vernal equinox year.
365.2425 days — the average length of a year in the Gregorian calendar.
365.25 days — the average length of a year in the Julian calendar.
365.2564 days — a sidereal year.
366 days — a leap year in many solar calendars.
383, 384 or 385 days — the lengths of leap years in some lunisolar calendars.
383.9 days (13 lunar months) — a leap year in some lunisolar calendars.
An average Gregorian year is 365.2425 days = 52.1775 weeks, 8,765.82 hours = 525,949.2 minutes = 31,556,952 seconds (mean solar, not SI). A common year is 365 days = 8,760 hours = 525,600 minutes = 31,536,000 seconds. A leap year is 366 days = 8,784 hours = 527,040 minutes = 31,622,400 seconds. The 400-year cycle of the Gregorian calendar has 146,097 days and hence exactly 20,871 weeks. See also numerical facts about the Gregorian calendar.

TABLE 5 PLANETARY REVOLUTIONS IN MAHAYUGA OF 4,320,000 YEARS

Planet	Khandakhadhyaka	Surya Siddhanta of Varaha	Modern SS
Moon	57753336	57753836	57753336
Sun	4320000	4320000	4320000
Mars	2296824	229824	2296832
Jupiter	364220	364240	364220
Saturn	146564	146564	146568
Moon's Apogee.	448219	448219	448203
Venus	7022388	7022388	7022376
Mercury	17987000	17937000	17937060
Moon's node	232226	232226	232238
Number of civil days	1577917800	1577917800	1577917828

THE MONTH

Lunar or Synodic Month - The **month** is a unit of time, used with calendars, which is approximately as long as some natural period related to the motion of the Moon. The traditional concept arose with the cycle of moon phases; such

months (lunations) are synodic months and last approximately 29.53 days. From excavated tally sticks, researchers have deduced that people counted days in relation to the Moon's phases as early as the Paleolithic age. Synodic months are still the basis of many calendars today.

This period is called the *synodic* month from the Greek *syn hodô* (σὺν ὁδῷ), meaning "with the way [of the sun]". Because of the perturbations of the orbits of the earth and Moon, the actual time between lunations may range from about 29.27 to about 29.83 days. The long-term average duration is 29.530588 days (29 d 12 h 44 min 2.8 s). The synodic month is used in the Metonic cycle. Thus the year based on a lunar month would be =29.53058181 *12= 354.3669817days. In other words, such a year would be short of a tropical year by about 11 days. But for societies that are not predominantly based on agriculture, such a lacuna would not be of great significance. It is perhaps for this reason that the Muslim calendar has chosen simplicity over temporal predictability when they decided to adopt the lunar calendar. This is the reason why important events in a Muslim calendar like Ramzan do not occur at the same time or date of every year, The Muslim calendar is a lunar calendar which makes no attempt at matching the periodicity of the solar calendar.

Sidereal Month - The period of the Moon's orbit as defined with respect to the celestial sphere is known as a *sidereal* month because it is the time it takes the Moon to return to a given position among the stars (Latin: *sidus*): 27.321661 days (27 d 7 h 43 min 11.5 s). As opposed to the Synodic or Lunar Month. This type of month has been observed among cultures in the Middle East, India, and China in the following way: they divided the sky into 27 or 28 lunar mansions, defined by asterisms (apparent groups of stars), one for each day of the sidereal month. The sidereal month is thus, about two day shorter (27.3217) than the Synodic month.

Like most Asian calendars Indian calendars do not employ the solar year and day (i. e. tropical year and solar day) but the Sidereal year, and the Synodic month (29.5306 days). Thus, the calendrical year based on the sidereal year is defined as the time between two successive passes of the sun through a certain star's circle of declination. Lunar days and sidereal months are also used, and in certain lunisolar calendars lunar year and lunar month are taken into account, too.

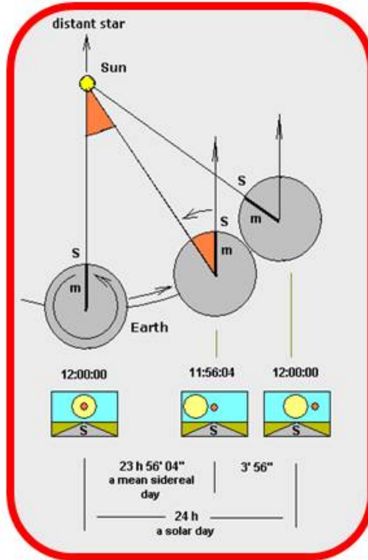
The Astronomical knowledge or the theory behind the observations of Ancient India was written down in scientific treatises, called Siddhantas. In them, values for the lengths of months and years were given representing the latest knowledge at the time the Siddhanta was written. The values range from 365.258681 days in the Âryabhatiya to 365.258756 days in the Surya Siddhanta and are all too long compared with the modern sidereal year length of 365.25636 days. Nevertheless they are still in use for Indian calendars today.

FIGURE 10. THE DIFFERENCE BETWEEN A SIDEREAL DAY AND A SOLAR DAY



the indic intellectual tradition





The difference between the sidereal day and the solar day from Wikipedia.

For the same reason the sidereal year is longer than the solar or tropical year by about 20 minutes.

We will come back to this when we discuss the precession of the equinoxes

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TABLE 6 THE NAMES OF THE SOLAR MONTHS(SAURAMAAS) ARE AS FOLLOWS

These names, also known as the **Rasi,** coincide with the names of the Solar Zodiac

Saura Maas (solar months)	Ritu (season)	Gregorian months	Zodiac	Devanagari
Mesha	Vasant (spring)	March/April	Aries	मेष
Vrushabha		April/May	Taurus	व्रषभ
Mithuna	Grishma (summer)	May/June	Gemini	मिथुन
Karka		June/July	Cancer	कर्क
Simha	Varsha (monsoon)	July/Aug	Leo	सिंह्
Kanya		Aug/Sept	Virgo	कन्या
Tula	Sharad (autumn)	Sept/Oct	Libra	तुळ
Vrushchik		Oct/Nov	Scorpius	वृश्चक
Dhanu	Hemant (autumn-winter)	Nov/Dec.	Sagittarius	धनु
Makara		Dec/Jan	Capricornus	मकर
Kumbha	Shishir (Winter-Spring)	Jan/Feb	Aquarius	कुंभ
Meena		Feb/Mar	Pisces	मीन

TABLE 7 MONTHS OF THE LUNISOLAR CALENDAR

The names of the months are based on the longitudinal position of the moon at mid month and are the adjectival form of the corresponding NAKSHATRA

caitra	चैत्र
vaiśākha	वैशाख
jyaiṣṭha	ज्यैष्ठ
āśāḍha	आशाढ
srāvaṇa	स्रावण
āśvina	भाद्रपद
āśvina	आश्विन
kārtika	कार्तिक
mārgaśīrṣa	मार्गशीर्ष
pauṣa	पौष
māgha	माघ
phālguna	फाल्गुन

THE ELEMENTS OF THE PANCHANGAM[7],[8],[9],[10]

The panchangam ,as the name suggests, has 5 distinct pieces of information.

TABLE 8 THE 5 ELEMENTS OF THE PANCHANGA

1.	Tithi (the day under study)
2.	Vaara (day of the week)
3.	Nakshatra (the asterism in which the moon is located)
4.	Yoga (that day's Yoga)
5.	Karana (that day's Karana) –

To calculate and specify the starting time and ending time of these FIVE quantities is called a Panchangam. The Indian Panchangam is really an almanac rather than calendar. It is analogous to the concept of a Farmers almanac that is widely prevalent in the west. The word calendar is itself of Greek origin. The Indics who devised the calendar faced the same problem that others faced in the ancient world, namely that the periodicities of the Sun and the moon are not exact integer multiples of one another. So, it is impossible to maintain consistency of seasons and phases of the month concurrently ,assuming that the civilization values the information conveyed by both of these sets of data. The resulting calendar while being complex, leaves no room for ambiguity in the interpretation of such a date, and can be maintained accurately with periodic corrections termed bija.

THE TITHI

According to the Indian calendar *or Panchangam, Tithi* is a lunar date based on the rotation of the moon around the earth, and is one of the five important aspects of an Indian almanac (*Panchangam* – *Panch* means five and *anga* means parts). Most of the Indian social and religious festivals are celebrated on a date corresponding to the original *Tithi*. The distance between the Sun and the Moon calculated on a daily basis is called Tithi. The positioning and the movements of both Sun and Moon are different (the Sun is much farther away than the moon , and hence it does not make sense to refer to the distance in terms of Miles are meters but in degrees only. As the space which is in the circle shape - is 360 degrees. So in a

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[7] Article written by Late Sri Pidaparthy Krishnamurthy Sastry in the Vijnana Sarvasam - by Andhra Saraswata Parishad – 1965

[8] Proceedings on 2nd Karnataka Astronomical Conference held in Mysore in 1934 under the President ship of Hon'ble Vepa Ramesam, the then Madras High Court Judge and others:

[9] Report of the Calendar Reform Committee by its Chairman Prof: Meghnath Saha, FRS, Ex MP- constituted by the Government of India.

[10] Kshayamasa Kartvya Nirnayam - By Late Sri Pidaparthy Krishnamurthy Sastry

month there are 30 days (or Tithis) that will bring us to the 12 degrees per Tithi (360/30) to calculate the distance between the Sun and the Moon. On the New Moon day - that is Amavasya - the distance between the Sun and Moon is only zero (0) degrees and at that time the Moon will have no light. On the full moon day the distance is 180 degree as both Sun and Moon are on opposite positions. So, that shows when the distance between Sun and Moon is 0 - 12 degrees that is defined as Padyami, and when it is 12-24 degrees that is defined as Vidiya (2nd day) and when the distance is 24-36 degrees that day is defined as Tadiya (third day).
There is another specific thing to be noted: the movements of the Sun are slow while the corresponding movements of the Moon are relatively rapid. If one takes the average motion (mean motion) of Sun, it is 59.1 minutes(1 degree is equal to 60 minutes) Where as the Moon's mean motion is about 790.56. So the difference between the Sun and Moon's motion is 790.56 - 59.1 = 731.46 that is equal to 12.19 degrees.
Whereas to gain the correct Tithi, one should not take the mean motions - one need to take accurate motion to obtain the right time of Tithi. There are functions to obtain this accurate motion to get the right Tithi.
In a month there are 30 Tithis- and on an average each Tithi will run for 23.62 hours. But, in many days, the Tithi usually hovering between 20 hours to 26.40 hours - and with this huge fluctuations, one can not depend upon the mean motions and this fluctuation occurs because of the daily changes in the motion of the Moon.
The timing of the performance of a particular aspect of a puja associated with a varety of rites and ceremonies is essential for the proper performance of the puja. Such an injunction was a corollary to the assumptions made in the belief system prevalent during the ancient era. As there are many kinds of writers of Panchanga- there is always a difference from one school of thought to another school of thought and the Tithis tend to get overlapped.

WEEK DAYS (VAARA)

Vaasara, often abbreviated as *vaara* in Sanskrit-derived languages, refers to the days of the week, which are possibly of Sumerian/Babylonian origin[1], and bear striking similarities with the names in many cultures:
Following are the Hindi and English analogues in parentheses

1. Ravi vāsara (*ravi-vaara* or Sunday; ravi = sun)
2. Soma vāsara (*som-vaara* or Monday; soma = moon)
3. Mangala vāsara (*mangal-vaara* or Tuesday; mangala = Mars)
4. Budha vāsara (*budh-vaara* or Wednesday; budh = Mercury)
5. Guru vāsara (*guru-vaara* or *Bruhaspati-vaara* or Thursday; vrihaspati/guru = Jupiter)
6. Shukra vāsara (*shukra-vaara* or Friday; shukra = Venus)
7. Shani vāsara (*shani-vaara* or Saturday; shani = Saturn)

8.

TABLE 9 DAYS OF THE WEEK

Days of the week
Sunday – Ravi- vasahara Raviwar, Adi, Aditya
Monday – Somwar (Chandrawar)
Tuesday – Mangalwar
Wednesday – Budhwar, Rauhineya, Saumya
Thursday – Guruwar, Brihaspati
Friday – Shukrawar, Bhrigu, Bhargava
Saturday – Shaniwar

There are many variations of these names in the regional languages, mostly using alternate names of the celestial bodies involved. The astonishing fact of the matter is that the system of dividing the week into 7 days is fairly widespread among all geographies and civilizations, and it is difficult to say when it originated .

The Indian Panchangam is really an almanac rather than calendar. It is really analogous to the concept of a Farmers almanac that is widely prevalent in the west. The word calendar is itself of Greek origin
The current calendar "date" based on the Gregorian Calendar that we are so familiar with in our daily life is heliocentric and is based on the rotation of the earth around the sun. It takes the earth approximately 365 ¼ days to complete its rotation around the Sun. The calendar that most of us use today divides the 365 days of earth's period of rotation around the Sun in twelve months. The leap year, which occurs once every four years, accounts for ¼ day per year.
Similar to the solar calendar, the lunar calendar is also popular and widely used in the Asian countries such as China, Pacific-rim countries, Middle East countries, and India. The lunar calendar, which is believed to have originated in India, has been around for a very long time, even long before the solar calendar.
The lunar calendar is geocentric and is based on the moon's rotation around the Earth. The lunar month corresponds to one complete rotation of the Moon around the Earth. Since this period of rotation of moon around the earth varies, the duration of lunar month also varies. On average, the lunar month has about 29 ½ days, the period of the lunar Synodic orbit. In addition to moon's rotation around the earth, the lunar year is based on earth's rotation around the Sun. In general, the lunar year has twelve lunar months of approximately 354 days
(29.5 *12), thus making it shorter by about 11 days than the solar year. However, the lunar calendar accounts for this difference by adding an extra lunar month about once every 2 ½ years. The extra lunar month is commonly known as "*Adhik Mas*" in India (*Adhik* means extra and the *Mas* means month). The concept of this extra month is similar to the "Blue Moon" in the West, which occurs almost with the same frequency of 2 ½ years.
The Indian lunar year begins on the new moon day that occurs near the beginning of the Spring season. The twelve lunar months are given below.

As mentioned earlier, to account for the difference between the solar and lunar year an extra lunar month occurs about every 2 ½ years as "*Adhik Mas".*[1] **[1]**

According to the Moslem calendar which is widely followed in Middle East and in other Moslem countries the lunar year is strictly based on twelve lunar months of 354 days per year. That's why their holy month of *Ramadan* occurs by approximately 11 to 12 days earlier than that in the preceding year.

The solar day (commonly referred as the "the date" in western calendar) has a fixed length of 24 hours. The change of date occurs at midnight as per local time or standard time of a given local time zone. Thus, the date changes from midnight to midnight. Similarly the day (as in weekdays) changes from midnight to midnight as per local or standard time for that location. In other words, as per the western (or English) calendar the length of day and date is exactly 24 hours, and there is a definite correspondence between the date and the corresponding day of the week.

A lunar day usually begins at sunrise, and the length of lunar day is determined by the time elapsed between the successive sunrises. As per the Jewish calendar their lunar day begins at the sunset, and lasts through the next sunset. A lunar day is essentially the same as a weekday. In India the lunar day is commonly referred as "*War*". Just as the English calendar has seven days for a week, the Indian calendar has seven *wars* for a week. Thus, The lunar day, however, varies approximately between 22 to 26 hours based on the angular rotation of moon around the earth in its elliptical orbit. In the Indian calendar, the lunar date is referred as "*Tithi*". The basis for the length of a lunar date is geocentric and is defined as the angular distance between the sun and the moon as seen from the earth. As the moon rotates around the earth, the relative angular distance between the sun and the moon as seen from the earth increases from 0 degrees to 360 degrees. It takes one lunar month or about 29 ½ solar days for the angular distance between the sun and the moon to change from 0 to 360 degrees. When the angular distance reaches zero, the next lunar month begins. Thus, at the new moon a lunar month begins, at full moon, the angular distance between the sun and the moon as seen from the earth becomes exactly 180 degrees.

The lunar cycle begins with crescent moon and the crescent phase lasts till that phase culminates in the full moon, typically lasting for about 15 days. Then the moon enters in the waning phase until it disappears from the sky by lining up with the Sun. The waning phase also lasts for about 15 days. According Indian lunar month, the crescent lunar phase fortnight is called as "*Shudha or Shukla Paksha*" and the waning phase of the lunar cycle fortnight as " *Krishna Paksha*". Thus, during *Shudha (or Shukla) Paksha* the angular distance between the moon and the sun varies from 0 degrees to 180 degrees while that during the *Krishna Paksha* from 180 to 0 degrees. If we divide 180 degrees into 15 equal parts, then each part becomes of 12 degrees in length. Thus, this each twelve-degree portion of angular distance between the moon and the sun as it appears from the earth is the lunar date or *Tithi*. *Tithis* or lunar dates in *Shudha (or Shukla) Paksha* begin with *Prathama* (first), *Dwitiya* (second), etc. till we reach the *Poornima*, the lunar date for full moon day. Similarly for the waning fortnight lunar cycle or *Wadya (or Krushna) Paksha*, *tithis* begin again with *Prathama* (first), *Dwitiya* (second), etc. till we arrive *Amavasya* or a day before the new moon. Thus when we refer to *Ramnavami* (the birthday of *Rama*), it's *the Navami* (ninth lunar day) of *Shudha Paksha* of the lunar month
Chaitra, or Chaitra Shudha Navami. Similarly, the *Gokulashtmi* (also called *as Janmashtami*, the birthday of *Krishna*) occurs on *Shrawan Wadya Ashtami* (eighth lunar day of *Wadya Paksha* of the lunar month *Shrawan).*

The angular velocity of moon in its elliptical orbit around the earth varies continuously as it is affected (according to Kepler's Law) by the relative distance between the earth and the moon, and also by the earth's relative distance from the sun. As a result, the daily angular speed (the speed of the angular change between the moon and the sun as seen from the earth) varies somewhere between 10 to 14 degrees per day. Since the length of a *Tithi* corresponds to 12 such degrees, the length of a *Tithi* also varies accordingly. Therefore, a *Tithi* can extend over one day (24 hour period) or it can get sorteneded if two *Tithis* occur in one 24 hour day.

Since the angular distance between the moon and the sun as referred here is always relative to the entire earth, a lunar day or *Tithi* starts at the same time everywhere in the world but not necessarily on the same day. Thus, when a certain *Tithi* starts at 10:30 PM in India it also begins in New York at the same time, which is 12 PM (EST) on the same day. Since the length of a *Tithi* can vary between 20 to 28 hours, its correspondence to a *War* (a weekday) becomes little confusing. As per the Indian calendar, the *Tithi* for a given location on the earth depends on the angular distance between the moon and the sun relative to the earth at the time of sunrise at that location. Thus, for instance, assume on a November

Monday sunrise in New York city occurs
8:30 AM (EST). Further assume that at 9 AM (EST) on Monday the angular distance between the sun and moon is exactly 12 degrees just following the new moon of the Indian lunar month *Kartik.* Since the length of a *tithi* is 12 degrees, the *tithi, Kartik Shudha Dwitiya* (second day) begins exactly at 9 AM on Monday of that November in New York. However, at the time of sunrise on that Monday the *tithi Dwitiya* has not begun. Therefore, the *tithi* for that Monday for city of New York is *Kartik Shudha Prathama* (first day).
On the same Monday morning the sunrise in Los Angeles occurs well past 9 AM (EST). Since the *Tithi Dwitiya* occurs everywhere in the world at the same instant, therefore, for Los Angeles, the *Tithi* for that Monday would be *Karthik Shudha Dwitiya.*
For the same Monday at 9 AM (EST), it would be 7:30 PM in Mumbai or New Delhi. Thus, *Tithi* for that Monday for city of New York, Mumbai, and New Delhi is *Karthik Shudha Prathama* (the first day of Indian lunar month *Karthik*) while for most of the regions west of Chicago or St. Louis the *Tithi* for that Monday is *Dwitiya*. In other words, the *Tithi Karthik Shudha Prathama* for regions west of Chicago or St. Louis should occur on the preceding day, the Sunday.
Karthik Shudha Prathama (the first day of Indian lunar month *Karthik*) also happens to be the first day after *Diwali*. Most of the Indians celebrate this as their New Year 's Day. Indians living in India, Europe, and eastern part of the United States thus should celebrate their New Year on that Monday while regions west of Chicago should celebrate on the preceding day, the Sunday. (Based on description by Jagdish C. Maheshri) October 12, 2000
[1] *Adhik Mas* occurs only when two *amavasyas* (no

TABLE 10 THE DAYS OF OF THE INDIAN LUNAR SYNODIC MONTH

Sl.No	Krsna **paksa** (dark fortnight) Waning moon	Gaura or shukla paksa (bright fortnight) Lightening moon	Deity and properties
1	Pratipat	Pratipat	The presiding deity of the first lunar day in Brahma and is good for all types of auspicious and religious ceremonies
2	Dvitiya	Dvitiya	Vidhatr rules this lunar day and is good for the laying of foundations for buildings and other things of a permanent nature.
3	Trtiya	Trtiya	Visnu is the lord of this day and is good for the cuttings of one's hair and nails and shaving.
4	Caturthi	Caturthi	Yama is lord of the 4th lunar day, which is good for the destruction of one's enemies, the removal of obstacles, and acts of combat.
5	Pancami	Pancami	The Moon rules this day, which is favourable for administering medicine, the purging of poisons, and surgery.

6	Sasti	Sasti	Karttikeya presides over this day and is favourable for coronations, meeting new friends, festivities, and enjoyment.

7	Saptami	Saptami	The 7th lunar day is ruled by Indra; one may begin a journey, buy conveyances, and deal with other such things as a movable nature.
8	Astami	Astami	The Vasus rule this day, which is good for taking up arms, building of one's defenses, and fortification.
9	Navami	Navami	The Serpent rules this day, with is suitable for killing enemies, acts of destruction, and violence.
10	Dasami	Dasami	The day is ruled by Dharma and is auspicious for acts of virtue, religious functions, spiritual practices, and other pious activities.
11	**Ekadasi**	**Ekadasi**	Rudra rules this day; fasting, devotional activities, and remembrance of the Supreme Lord are very favourable.
12	Dvadasi	Dvadasi	The Sun rules this day, which is auspicious for religious ceremonies the lighting of the sacred fire, and the performance of one's duties.
13	Trayodasi	Trayodasi	The day is ruled by Cupid and is good for forming friendships, sensual pleasures, and festivities.
14	Caturdasi	Caturdasi	Kali rules this day suitable for administering poison and calling of elementals and spirits.
15	Amavasya (**new moon**)	Purnima (**full moon**)	The Vasve-devas rule the New Moon suitable for the propitiation of the Manes and performance of austerities.

THE NAKSHATRA AND THE KEY ROLE IT PLAYS IN ANCIENT INDIAN ASTRONOMY

The basis of the Hindu calendar calculation is Vedic[2]. This calendar has been modified and elaborated, but because it is based on the stars (Nakshatras) visible to the naked eye, and on the visible Lunar phases, it is more accurate than any others of the past. The actual moments when Lunar months begin, can easily be checked by the regular appearances of Solar eclipses, and the middle moment of a Lunar month -- Poornima or full moon -- can similarly be verified by the more

frequent Lunar eclipses. Hence the Hindu calendar, not requiring special instruments for its rectification, has maintained great accuracy for thousands of years.
The oldest calendar is probably the Vedic calendar among the languages referred to as IE languages; at first lunar, later with solar elements added to it. The sister Avesta calendar is similarly first Lunar, but later only Solar. Both these calendars (the oldest in the IE universe) are influenced by the prehistoric calendars of the first and second root races at the North Pole and its surroundings, as they reckon with days and nights lasting six months.
It was the impression of knowledgable Indologists such as William Brennand[11] that the Hindus have been observing and recording the the motion of the moon, the sun and the seven planets along a definite path that circles our sky, now known as the ecliptic, and is marked by a fixed group of stars clustered around this ecliptic. The moon afforded the simplest example. These early astronomers observed that the moon, moving among these fixed star constellations, more accurately referred to today as Asterisms (as opposed to the use of the term Constellation, which is term with a specific menaing in this case the total number is fixed as 88 by th e IAU) which they called Nakshatras, returned to the same Nakshatra in 27.32166 days, the exact quantity determined by Aryabhatta, thus completing one Nakshatra month or Sidereal Month. They found it convenient to divide these groups of stars into 27 almost equal sections, or the 27 Nakshatras. Thus mathematically a naskshatra is equal to $1/27^{th}$ of the sidereal Zodiac. In other words, it occupies 13 dregrees and 20 minutes along theecliptic. By this method of reckoning, instead of giving the date of a month, as Western calendars do, the Hindus gave the name of the Nakshatra in which the moon was to be seen. (The moon is in each of these Nakshatras for approximately one day plus eighteen minutes)
This scheme fitted nicely with the sun's cycle, for the Hindus noted that the sun traversed the same circle through the sky, but that it returned to its starting place only after 365.258756481 days, or what we call a Solar Sidereal Year. (Modern figures based on this Hindu figure quote 365.2596296 days -- a distinction without a difference, for ordinary purposes.) Now, having already divided the month into the 27 Nakshatras for the convenience of reckoning the moon's voyage through the heavens, what was more natural than that these same Nakshatras should serve for the study of the Sun's course? Being in a circle of 360 degrees, each Nakshatra takes up 13 1/3 degrees of that circle. The Sun, moving about 1 degree in a day, is seen for 13 1/3 days in each Nakshatra. The system of reckoning according to the moon Nakshatras is current today in other cultures, that of the sun's being uncommon.

During the course of one day, the earth has moved a short distance along its orbit around the sun, and so must rotate a small extra angular distance before the sun reaches its highest point. The stars, however, are so far away that the earth's movement along its orbit makes a generally negligible difference to their apparent direction (see, however parallax), and so they return to their highest point in slightly less than 24 hours. A mean sidereal day is about 23h 56m in length. Due to variations in the rotation rate of the Earth, however, the rate of an ideal sidereal clock deviates from any simple multiple of a civil clock. The actual period of the Moon's orbit as measured in a fixed frame of reference is known as a Sidereal month, because it is the time it takes the Moon to return to the same position on the celestial sphere among the fixed stars (Latin: sidus): 27.321 661 days (27 d 7 h 43 min 11.5 s) or about 27 ⅓ days. This type of month has appeared among cultures in the Middle East, India, and China in the following way: they divided the sky in 27 or 28 lunar mansions or Nakshatras, characterized by asterisms (apparent groups of stars), one for each day that the Moon follows its track among the stars.

In brief, then, the earliest method, the Vedic, of counting, was to name the moon through the various Nakshatras -- the circle or cycle repeating itself each Sidereal-Star-Month. Later the sun's place in the same Nakshatras was noted, the year ending when the Sun returned to the same Nakshatra. Then came the noting of the Solar and Lunar eclipses, and the observance of the New and Full Moons divided the month into the two phases of waxing and waning Moon, the month beginning at the moment of New Moon. This is how the Hindus reckon today, the month taking its name from the Nakshatra in which the Full Moon is seen each month. The Full Moon being exactly opposite the Sun, the Solar nakshatra bears the same name as the Lunar month six months ahead, while each Lunar month bears the same name as the 14th

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[11] William Brennand(1896) , "Hindu Astronomy", Reprinted by Caxton Publications, New Delhi, India, 1988

Solar Nakshatra ahead.
The Western student faced with these unfamiliar calculations may echo the old Persian proverb, "Why count big numbers and small fractions, when they are all amassed in 1?" But the Hindu looks on these figures from another point of view -- he lives with them, and among them, and by them, much of the time. Consider a Sanskrit sloka (verse) about the Savati or pearl nakshatra, which marks the new season after the monsoon is over. The sloka says, "If in the Swati a rain drop falls into the sea, that drop becomes a pearl." This may sound foolish, for the peasant, though he live in the depth of the interior of India, knows that pearls come from the sea -- even if he does not necessarily understand that these pearls grow inside the oyster. He does know, however, that if it rains at this period of the year, his crops will yield great wealth. And the pearl is synonymous with wealth among people who, if they have any money, invest it in jewelry, especially gold and pearls, rather than in the banks. (Poetically, rice, their staple food).

NAKSHATRA AND THE PRECESSION OF THE EQUINOXES

To summarize, the earth revolves around the Sun once in 365 days 5 hours 48 minutes and 46 seconds. Considered from the earth, the Sun appears to complete one round of the ecliptic during this period. This is the Tropical year. In the span of a tropical year, the earth regains its original angular position with the Sun. It is also called the Year of seasons since the occurrence, and timing, of seasons depends on the rotation of the earth around the sun. If, for example, we consider the revolution of the Sun around the earth from one vernal equinox (around 21st March, when the day and night all over the globe are equal) to the next vernal equinox, it takes one tropical year to do so.
However, if at the end of a tropical year from one vernal equinox to the next, we consider the position of the earth with reference to a fixed star of the zodiac, the earth appears to lie some 50.26 seconds of celestial longitude to the west of its original position. In order for the earth to attain the same position with respect to a fixed star after one revolution, it takes a time span of 365 days 6 hours 9 minutes and some 9.5 seconds. This duration of time is called a sidereal year .The sidereal year is just over 20 minutes longer than the tropical year; this time difference is equivalent to 50.26 seconds of celestial longitude.
Each year, the Vernal equinox will fall short by 50.26 seconds along the zodiac reckoned along the fixed stars. This continuous receding of the Vernal equinox along the zodiac is termed the Precession of the Equinoxes and it takes about 25776 years to make one complete revolution of the precessional motion of the earth’s axis. Hipparchus regarded as the discoverer of the precession of the equinoxes in the west gave us either 28,000 or 28,173 years for one revolution..
Another figure given is 25,920 years for the precession cycle. These figures indicate that the mean value of 27,000 years given in the Vedic scriptures is reasonable. The precession of the equinoxes has proved to be very useful for dating certain events in Vedic and Post Vedic times.
There are only a few methods, by which we can determine the age of an event in the absence of radiocarbon dating which is not as precise as the astronomical clocks. Use the Precession of the equinoxes to determine the Nakshatra in which the Vernal equinox occurs in a particular Nakshatra. If, we recall there are 27 Nakshatras, it follows that the vernal equinox occurs in a different Nakshatra, once every 955 years.
Use the statements made in the texts to check for internal consistency. If for example Aryabhatta uses a place value system, the zero must have been in fairly wide use by then. If further he uses classical sanskrit (codified by Panini then he must have lived after Panini.
9 degrees to either side of the Ecliptic is a belt of the Heavens known as the Zodiac. (Dante called it the Oblique Line that beareth all planets).The first 30 degrees of the Zodiac constitute the sign of Aries.,the next 30 degrees Taurus and so on. The Zodiac counted from the first degree of Aries to the 360th degree of Pisces is called the Tropical Zodiac. These 12 signs are the limbs of the Cosmic Man or Time Eternal (Kalapurusha - The Almighty Self as Time). Aries is His head, Taurus His face, Gemini His neck, Cancer His heart, Leo the place beneath, Virgo His belly, Libra His generative organs, Scorpio the place beneath, Sagittarius His upper thigh, Capricorn his lower thigh, Aquarius His leg and Pisces His feet! Each Nakshatra is associated with a deity, and that the deities associated with tha Nakshatra are mentioned in the Riv Veda Samhita is due to the research of Narahari Achar[130]. The antiquity of the naksatra system becomes clear when it is recognized that all the deity names occur in RV 5.51 (this insight is due to Narahari Achar21). This hymn by Svasty¯atreya ¯ Atreya lists the deity names as: A´svin, Bhaga, Aditi, P¯usan, V¯ayu, Soma, Brhaspati, SARVAGAN. AH.Vi´sve Devah. Agni, Rudra, Mitra, Varun.a, Indr¯agni. The sarvaganah are the ganah.
(groups) such as the Vasavah. Pitarah.Sarpah.ncluding Ahi and Aja), ¯ Apah. , and the ¯ Adityaganah Daks.a

Praj¯apati,Aryaman, Vis.u, Yama, Indra) complete the list. There is no doubt that the ecliptic is meant because the last verse of the hymn refers explicitly to the fidelity with which the sun and the moon move on their path, the ecliptic. The division of the circle into 360 parts or 720 parts was also viewed from the point of view the nakshatras by assigning 27 upanakshatras to each nakshatra (´ Satapatha Br. 10.5.4.5). This constituted an excellent approximation because 27 × 27 = 729. In other words, imagining each nakshatra to be further divided into 27 equal parts made it possible to conceptualize half a degree when examining the sky.

TABLE 11 THE INDIAN NAKSHATRA

Number	Western Zodiac name	(Sidereal	Deity	Sector in deg,min	Meaning
1.	Beta Arietis	Aswini (Asvayjau)	Asvinau	00 00 13 20	A Horse's head
2.	41 Arietis	ApaBharani	Yama	13 20 26 40	Yoni or Bhaga
3.	Eta Tauri	Karthika	Agni	26 40 40 00	Razor
4.	Alpha Tauri	Rohini	Prajapati	40 00 53 20	A wheel carriage
5.	Lamda Orionis	Mrigasira	Soma	53 20 66 40	The head of an antelope
6.	Alpha Orionis	Aridra	Rudra	66 40 80 00	A gem
7.	Beta Geminorum	Punarvasu	Aditi	80 00 93 20	A house
8.	Delta Cancri	Pushya	Brihaspati	93 20 106 40	An arrow
9.	Alpha Cancri	Aslesha	Sarpah	106 40 120 00	A wheel
10.	Alpha Leonis	Magha	Pitarah	120 00 133 20	Another house
11.	Delta Leonis	Purva Phalguni	Aryaman (Bhaga)	133 20 146 40	A bedstead
12.	Beta Leonis	Uttara Phalguni	Bhaga (Aryaman)	146 40 160 00	Another bed stead
13.	Gamma Virginis	Hasta	Savitar	160 00 173 20	A hand
14.	Alpha Virginis(spica)	Chitra	Indra (Tvastr)	173 20 186 40	A pearl
15.	PI Hydrae	Svati	Vayu	186 40 200 00	A piece of Coral
16.	Beta Librae	Vishaka	Indragni	200 00 213 20	A festoon of leaves
17.	Delta Scorpi	Anuradha	Mitra	213 20 226 40	An oblation to the Gods
18.	Alpha Scorpi	Jyeshta	Indra (Varuna)	226 40 240 00	A rich ear ring
19.	Lamda Scorpi	Moola	Pitarah	240 00 253 20	The tailof a fierce lion
20.	Delta Sagittari	Poorvashad	Aapah	253 20 266 40	A couch
21.	Delta Sagittari	Uthrashad	Visvedevah	266 40 280 00	The tooth of a wanton elephant, near which lies thekernel of the springataca nut
22.	Beta Capricornus	Sravana	Visnu	280 00 293 20	The three footed step of vishnu
23.	Alpha DelphiniDelta capricornus	Dhanishta (Sravistha)	Vasavah	293 20 306 40	A tabor

24.	Lamda Aquar	Satabhishaj	Varuna	306 40 320 00	A circular jewel
25.	Alpha Pegasi	Poorvabhadrapada (prosthapada)	Aja Ekapad	320 00 333 20	Aa two faced image
26.	Alpha Andromeda	Uttrarabhadra (Uttara	Ahirbudhya	333 20 346 40	Another couch
27.	Zeta Piscium	Revathi	Pusan	346 40 360 00	A small sort of tabor

TABLE 12 VALUES FOR THE LUNAR SIDEREAL ORBIT AND THE LUNAR SYNODIC ORBIT

COMPARISONS	**Lunar orbit sidereal**	**Lunar orbit synodic**
AD 2000.0	**27.32166156**	**29.53058888**
AD 498	**27.3216638**	**29.530591**
Àryabhata	**27.321668**	**29.530582**
Paulisa Siddhanta	**27.321673**	**29.530587**
Surya Siddhanta		**29.530587946**

The remaining 2 items in the Panchaga, the Karana and the Yoga are not as conceptual and are more derivative in nature.

Karana

A *karana* is half of a tithi. To be precise, a *karana* is the time required for the angular distance between the sun and the moon to increase in steps of 6° starting from 0°. (Compare with the definition of a tithi above.)
Since the *tithi*-s are thirty in number, one would expect there to be sixty *karana*-s. But there are only eleven. There are four "fixed" *karana*-s and seven "repeating" *karana*-s. The four "fixed" *karana*-s are:

1. Kimstughna
2. Shakuni
3. Chatushpād
4. Nāgava

The seven "repeating" *karana*-s are:

1. Bava
2. Bālava
3. Kaulava
4. Taitula
5. Garajā
6. Vanijā
7. Vishti (Bhadrā)

- Now the first half of the first *tithi* (of the bright fortnight) is always *Kimstughna karana*. Hence this *karana* is "fixed".

- Next, the seven repeating *karana*-s repeat eight times to cover the next 56 half-*tithi*-s. Thus these are the "repeating" *karana*-s.
- The three remaining half-*tithi*-s take the remaining "fixed" *karana*-s in order. Thus these are also "fixed".
- Thus one gets sixty *karana*-s from eleven.

The *karana* active during sunrise of a day is the *karana* for the day.

(Rasi) Saur Maas (solar months)	**Ritu (season)**	**Gregorian months**	**Zodiac**
Mesh	Vasant (spring)	March/April	Aries
Vrushabh		April/May	Taurus
Mithun	Grishma (summer)	May/June	Gemini
Kark		June/July	Cancer
Simha	Varsha (monsoon)	July/Aug	Leo
Kanya		Aug/Sept	Virgo
Tula	Sharad (autumn)	Sept/Oct	Libra
Vrushchik		Oct/Nov	Scorpius
Dhanu	Hemant (autumn-winter)	Nov/Dec.	Sagittarius
Makar		Dec/Jan	Capricornus
Kumbha	Shishir (Winter-Spring)	Jan/Feb	Aquarius
Meen		Feb/Mar	Pisces

YOGA

First one computes the angular distance along the ecliptic of each object, taking the ecliptic to start at *Mesha* or Aries (*Meshādi*, as defined above): this is called the longitude of that object. The longitude of the sun and the longitude of the moon are added, and normalized to a value ranging between 0° to 360° (if greater than 360, one subtracts 360.) This sum is divided into 27 parts. Each part will now equal 800' (where ' is the symbol of the arcminute which means 1/60 of a degree.) These parts are called the *yoga*-s. They are labeled:

1. Vishkambha
2. Prīti
3. Āyushmān
4. Saubhāgya
5. Shobhana
6. Atiganda
7. Sukarman
8. Dhriti
9. Shūla
10. Ganda
11. Vriddhi
12. Dhruva
13. Vyāghāta
14. Harshana
15. Vajra
16. Siddhi
17. Vyatīpāta
18. Varigha
19. Parigha
20. Shiva
21. Siddha
22. Sādhya
23. Shubha
24. Shukla
25. Brāhma

26. Māhendra
27. Vaidhriti

Again, minor variations may exist. The *yoga* that is active during sunrise of a day is the *yoga* for the day.

TABLE 13 COMPARISON OF SOME ASTRONOMICAL CONSTANTS

ASTRONOMIC AUTHORITY	Àryabhata (from Clarke and Kay)	Surya Siddanta	2007
Years in Cycle ,MY	4,320,000	4,320,000	4,320,000
Rotations,R	1,582,237,500	1,582,237,828	
Days in a MY, DMY	1,577,917,500	1,577,917,828	
Mean Rotations of the earth in a Sidereal year R/KY=1 +DSiYr			366.2587565
Lunar Orbits one MY,	57,753,336	57,753,336	
Days in a Sidereal month,DSiM = 1577917500/57753336 = 27.32166848			
Kaye notes 57,753,339 lunar orbits rather than 57,753,336 per Clarke.			
Synodic Months MSyn in a MY	53,433,336	53,433,336	
Days in a synodic month DSynM = 1,577,917,500/53,433,336=29.53058181 days			
Mercury	17,937,920	17,937,060	
Venus	7,022,388	7,022,376	
Mars	2,296,824	2,296,832	
Jupiter	364,224	364,220	
Saturn	146,564	146,568	

[30] Achar, Narahari "In search of Contemporary views on Indian civilization" , Proceedings of the Waves conference held in Hoboken, NJ, 2000, edited by Bhudev Sharma

HOW OLD IS THE UNIVERSE, KALACHAKRA AND THE YUGA CONCEPT, HINDU COSMOLOGICAL TIME FRAMES

The Hindu Calendar or more appropriately Almanac(also known as the Panchanga) currently in practice reckons time in terms of very large cycles called Kalpa (4.32 billion years) consisting of 14 Manavantaras(Manavantaras or age of Manu,~ 308 million years). A Manavantaras is made up of Mahayugas (Mahayuga= great yuga consists of 4 yugas: Krta, Treta, Dwapara and Kali). Kali yuga is equivalent to 432,000 years and 1 Mahayuga= 4.32 million years. This system appears to have been in use since the days of the Epics and Puranas, and attested in the Siddhantas. However, the earliest Vedic Calendar was based on a cycle also called yuga, but consisting of only five years. This ancient Vedic Calendar was a lunisolar calendar and used two intercalary months in a five year period and has often been criticized as being very crude. First we have Kalpa, a day in Brahma's 'life' or 4320 million earthly years, and a night of equal length. During the day he creates and during the night he absorbs to begin the cycle each Brahma day . Each kalpa is divided into 14 Manavantaras or

308.448 million years we are supposed to be in the seventh Manavantaras of Vaivasvata Manu. Each Manavantaras contains 71 Mahayugas, plus 1 Krtayuga ,and each Mahayuga is divided into 4 yugas — Krta, Treta, Dwapara and Kali of 4800, 3600, 2400 and 1200 divine years of the Gods, each of which = 360 human years. We are at present in the Kali yuga which began in 3102 BCE the traditional year of the Mahabharata war .

TABLE 14 A DAY IN BRAHMA'S LIFE OF 1 KALPA

1 Brahma Day (day and night) = 2 Kalpa
1 Kalpa = 4,320,000,000 earthly years (Y) =14 Manus + 1Kritayuga = 1000 MY =14*71.4+.4 Mahayugas
Kaliyuga = 432,000 Y = 1KY = 1200 divine years (DY) = 1 Yuga
1 DY = 360 Y
Dwapara = 864,000 Y = 2KY = 2400 DY
TretaYuga = 1,296,000 Y = 3KY = 3600 DY
Kritayuga = 1,728,000 Y =4 KY = 4800 DY = 0.4 MY =.4/71.4 = 5.6022408964e-3
Mahayuga (MY) = 4,320,000 earthly years = 10 KY = 12000 DY
1Manvantra (M) = 71 MY = 306.72 million years
1 Manu = 1M + 1 KritaYuga = 308.448 million years = 856,800 DY
1 Kalpa = 14 Manus + 1KritaYuga = 14*71.4 +.4 = 1000 MY = 12,000,000 DY = 4.32 billion
Y = solar or tropical year
DY = 360 Y = divine year
KY = 432,000 = Kaliyuga

MY = 10 KY = Mahayuga

TABLE 15 HOW OLD IS THE UNIVERSE

As of Vaisakhapratipada of 2009 CE, May 1 we are in the second quarter of Brahma day (द्वितिय परार्थ), called Shweta Varaha Kalpa, seventh Manavantaras named Vaivasvata and entered into the first quarter of the 28th Kaliyuga. Already 5110 years of this 28th KY have passed. so the time elapsed in this Kalpa is 6 Manus =1,850,688,000 Y = [6*(306,420,000+1,728,000)] = 6 Manus (includes 6 Jala pralayas or sandhis, periods between Manavantaras) And 27 MY = 116,640,000 Y (27 * 4,320,000)=27/71.4M = 0.3781512605 M
Add 1 Jala Pralaya(depending on origin of cycle) = 1,728,000 Y
And 28th (Krta+Treta +Dwapara) = 3,888,000 Y (9*432,000) =0.9 MY =.9/71.4 = 0.012605042M
5110 Y of Kaliyuga = 5110 Y = 5110/4,320,000 MY = 1.1828703704 (10*-3) MY
the current year 2009 CE = 1,850,688,000 + 116,640,00 +1,728,000 + 3,888,000 + 5110 = 1 ,972,949,110 Y or Solar years or 1.972949110 Billion years
= 426+27+(.4*7) + .9 +.001182703704 = 456.701182703704 MahaYugas
To put this in perspective, if we look at a galaxy 2 billion light years away (a unit of distance) we would be looking at an object in time contemporaneous with the age of 1 Brahma day or the birthday of our solar system. It is incredible that the Indic ancients were able to fathom such cosmological time frames merely by the use of Observational Astronomy, using just his naked eye, especially when it is recalled that the Romans had no name for a number greater than a thousand, and the state of Tennessee passed a law saying that the value of PI should be legislated to be 3, as late as the 2nd half of the nineteenth century

The 12 signs of the Zodiac with Sanskrit names are mentioned in the Brihat Samhita and Laghu Bhaskariyam. The former is the work of Varahamihira 505 CE. He is supposed to have borrowed it from a Greek of the 4th century BCE (Could it be Hipparchus). The whole theory of India borrowing from the Greeks needs to be re-examined in greater detail, since it is now clear that the methods used by the Indics were quite unique and distinct from those used by the Greeks. Further Yajnavalkya is credited with discovering that it takes 95 years to synchronize the motions of the sun and the moon The Indic tradition moreover is a living tradition which is practiced by Jyotish even till today. Surely such an observation would have been preceded by extensive data collection and the ability to manipulate large numbers mathematically and the ability to use a written script. There is ample evidence that the Shatapatha Brahmana and the Brhadaranyaka Upanishad both of which are credited to Yajnavalkya, and which contain significant amount of Astronomical observations predate the advent of the Greeks and possibly even the Babylonians. Quote from Koenraad Elst “To conclude this brief acquaintance with Vedic astronomy, we want to draw attention to the possible presence in the Rg-Veda of a momentous cultural artifact, the origin of which is usually situated in Babylonia in about 600 BC: the twelve-sign Zodiac. In RV 1:164:11, the sun wheel in heaven is said to have 12 spokes, and to be subdivided into 360 pairs of “sons”: the days (consisting of day and night), rounded off to an arithmetically manageable number, also the basis of the “Babylonian” division of the circle in 3600. The division in 12 already suggests the Zodiac, and we also find, in the footsteps of N.R. Waradpande, that a number of the Zodiacal constellations/ rAshis (classically conceived as combinations of 2 or 3 successive Lunar mansions or Nakshatras of 13 ˚ and 20’ each) are mentioned. Obviously the Rg should be dated prior to the beginning of Kaliyuga, as we have already demonstrated and hence the Babylonian origin of the twelve sign Zodiac is suspect.”

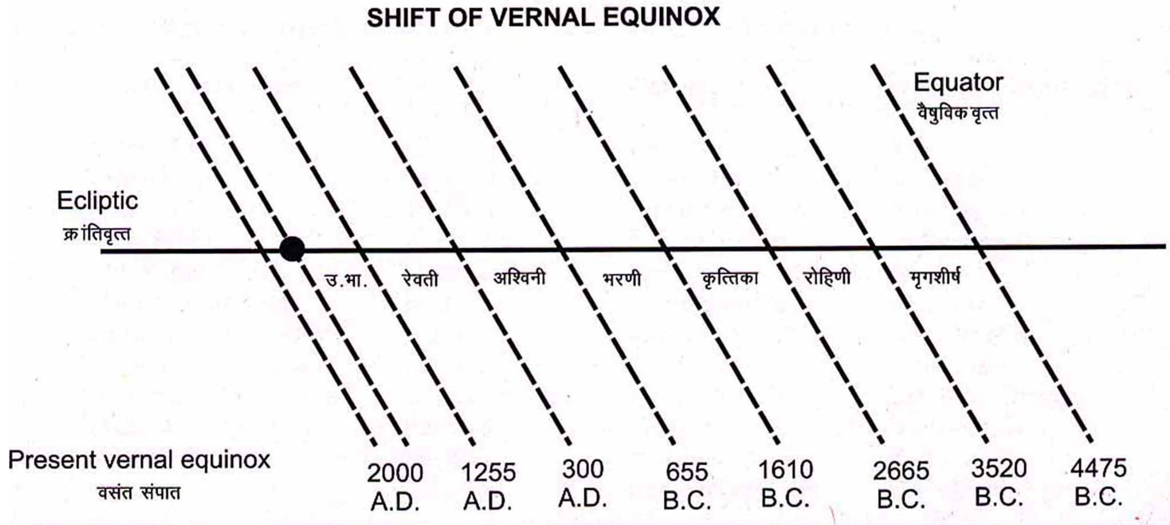


Figure 6 The shift of the vernal equinox through different Nakshatras over 6 millennia

The Zodiac is also tenanted by 27 constellations each of them spread over an arc of 13 degrees 20 minutes. The Zodiac counted from the first degree of Beta Arietis (Aswini) to the 360th degree of Zeta Piscium (Revathi) is known as the Sidereal[3] Zodiac.

[2]The following is based on an original account by Dr. Dwarakanath a physicist. He teaches sanskrit during his free time and is interested in vedic learning and vedanta.

[3]Sidereal month the actual period of the Moon's orbit as measured in a fixed frame of reference is known as a *sidereal* month, because it is the time it takes the Moon to return to the same position on the celestial sphere among the fixed stars (Latin: *sidus*): 27.321 661 days (27 d 7 h 43 min 11.5 s) or about 27 ⅓days. This type of month has appeared among cultures in the Middle East, India, and China in the following way: they divided the sky in 27 or 28 lunar mansions, characterized by asterisms (apparent groups of stars), one for each day that the Moon follows its track among the stars.

CHAPTER II HISTORY OF THE CALENDAR IN INDIA

APPENDIX A GLOSSARY

A

Abda - Year (as in Yugabda 5110 (2009)

Abhijit, अभिजित - Abhijit Nakshatra: Abhijit Nakshatra is called the intercalary(IC) Nakshatra as it appear as a small (smaller duration as compared to normal duration of Nakshatra 13d 20m) Nakshatra between Uttarashadha and Sravana. The duration of Uttarashadha is divided into four parts and the first three paadas are assigned to Uttarashadha, which makes the duration of Uttarashadha to be 10deg with each paada to be 2d 30m. The remaining one paada of Uttarashadha is assigned to Abhijit, the intercalary Nakshatra. Similarly beginning 1/15th part of Sravana is given to Abhijit, making its total length to be 253.33 min, i.e., 4d 13m 20s. The remaining 14/15th part of Sravana is assigned to the four padas of Sravana, making the total duration of Sravana to be 12d 26m 40s

Acharya, आचायर् - a spiritual guide or teacher. See Sankaracharya

Adharma, अधमर् - absence of righteousness, disorder, evil, immorality

Adhikamaasa or intercalary month - Leap month or intercalary month introduced to account for the lack of synchronization between a lunar period and a solar period, i.e., the solar period (or year) is not an exact multiple of a lunar month. Literally means additional month. An intercalation takes place when 2 lunar months begin in the same solar month, ,the former of the 2 is called the intercalary month or adhikamaasa

Adi,आिद - first, primordial as in Adi Sankara

Aditi, अिदित -In Hinduism, Aditi (Sanskrit - limitless) is a goddess of the sky, consciousness, the past, the future and fertility. She is an ancient goddess, mother of Agni and the Adityas with Kashyapa. She is associated with cows, a very holy animal in Hindu beliefs. Aditi is the daughter of Daksha and Veerni. She gave birth to the Devas who were beautiful, intelligent and pious to the Almighty. Although the goddess Aditi is mentioned nearly eighty times in the rg-veda, it is difficult to get a clear picture of her nature. she is usually mentioned along with other gods and goddesses, there is no one hymn addressed exclusively to her, and unlike many other vedic deities, she is not obviously related to some natural phenomenon. compared to Usha and Prithvi, her character seems ill defined. she is virtually featureless physically. perhaps the most outstanding attribute of Aditi is her motherhood. She is preeminently the mother of the Adityas, a group of 7 or 8 gods which include Mitra, Aryaman, Bhaga, Varuna, Daksha and Ansa.

(2.27.1) Aditi is also said to be the mother of the great god Indra, the mother of kings (2.27), and the mother of gods (1.113.19). Unlike Prithvi, however, whose motherhood is also central to her nature, Aditi does not have a male consort in the Rg-veda. as a mothering presence, Aditi is often asked to guard the one who petitions her (1.106.7 ; 8.18.6) or to provide him or her with wealth, safety, and abundance (10.100; 1.94.15).

Aditya, आिदत्य - In Hinduism, the Adityas are a group of solar deities, sons of Aditi and Kashyapa. In the Rigveda, they are seven deities of the heavens, chief of these being Varuna, followed by Mitra, Aryaman, Bhaga, Daksha, and Ansa, the seventh Aditya was probably the Sun, Surya or Savitar. As a class of gods, the Rigvedic Adityas were distinct from the Visvedevas. In the Yajurveda (Taittiriya Samhita), their number is given as eight. In the Brahmanas, their number is expanded to twelve, corresponding to the twelve months:Ansa ,Aryaman, Bhaga ,Daksha ,Dhatri, Indra, Mitra, Ravi, Savitar, Surya , Varuna, Yama Aditya in the (Chāndogya-Upanishad) is also a name of Vishnu, in his Vamana (dwarf) Avatar. Dictionary of Hindu Lore and Legend (ISBN 0500510881) by Anna Dhallapiccola

adhyasa, अ ासा - used to refer to the 'mistake' that we make when we 'superimpose' a false appearance upon the reality or mix up the real and the unreal.

Adrishta - opposite of drishta or Unseen,a metaphor for the consequences of past actions,which may be unanticipated

advaita,अतै - not two (dvaita)

Agama,आगाम -Ancient Sanskrit religious text

Ahimsa,अिहम्स -abstention from injury to all life forms

amAvasya, अमावस्य़ -new moon

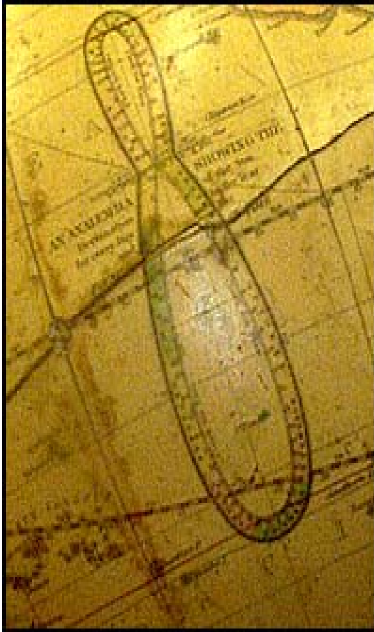
analemma

At noon in a perfect world, the sun would always be positioned 93 million miles directly over the equator, and the Earth,

an unblemished sphere, would rotate evenly on a precisely vertical axis. The seasons would never change. Every day would last as long as every other. And we'd never have the equinoxes and solstices that mark the four quarters of the year.

As it happens, however, the Earth's axis is tilted and, according to Ruth Freitag, a senior science specialist at the Library of Congress, the "slightly eccentric ellipse" of the Earth's orbit around the sun led astronomers to come up with a consistent way to determine mean time, the time by which we all set our clocks. "The natural system is full of variables, and that's without even considering the irregularities of the Earth's rotation, which came to light in the late 19th century," says Freitag.

Thus we have the analemma, the somewhat mysterious looking figure-eight diagram on many globes and maps. The analemma charts where and when the sun will appear directly overhead in the "torrid zone," between the Tropic of Cancer and the Tropic of Capricorn. The curves of the analemma also mark the solstices and equinoxes. The winter solstice, occurring when the sun is at its southernmost position in the torrid zone, is shown on the most extreme point of an analemma's lower arc.





"In the days before the radio, the analemma was also useful for correcting clocks," says author David Greenhood in his book "Mapping."

The days may be dark now but the horizon looks bright: Since the winter solstice marks the shortest day and the longest night of the year, the days will begin to stretch out from now until the summer solstice. Come February and March, when cold temperatures have you fearing that winter will never end, at least the sun will hang a little longer in the evening sky.



AnumAna, अनु -anumaana or inference is one of the most importrant contributions of
मान
the system of metaknowledge known as Nyaya (which translates as Logic)
Anushtup chandas - A meter in prosody with 32 syllables
Aparapaska -full moon to new moon period

Apastambha अपस्तम्भ - Apastambha was an ancient Vedic savant ,who composed the Sulvasutra named after him, credited with approximation for square root of two. His goal was among others to design ritual altars and to conform to the rules of Vastu Sastra,circa 2500 BCE. Apastambha predates Aryabhatta since Aryabhatta refers to the Sulvasutras in his magnum opus Aryabhattium

Artha, अथर् - Object, purpose, aim, significance, import. Attainment of worldly riches, prosperity, wealth, one of the goals of life prescribed by the Vedics in the Brahma Vidya

Aranyakas, आरण्यक -The third part of each of the Vedas (after Samhitas, and Brahmanas) elaborating various spiritualistic practices for forest dwelling initiates into spirituality. The Aranyakas (Sanskrit *āraṇyaka*) are part of the Hindu śruti; these religious scriptures are
sometimes argued to be part of either the Brahmanas or Upanishads. The name translates to "the forest books", meaning, treatises for hermits or sadhus living in the wilderness. This contrasts with the grhyasutras, treatises intended for domestic life. Their language is early Classical Sanskrit, and together with the bulk of the Upanishads, the Aranyakas form the basis of Vedanta,
Arati -A ritual in which a plate or thali with a deepa(oil lamp) and other items of ritual purification such ahs flowers, incense,kumkum and turmeric, are waved at lelast 3 times clockwise around a venerated person or object. Sometimes the plate may contain just water with kumkum dissolved in it .

Arjava, आजर्व - straightforwardness at all times

Arjuna - The third of the five pandava princes, whose expertise lies in Archery . He is the protagonist in the Bhagvad Gita, the disciple of his friend and mentor Sri Krishna, the avatar of the Lord Himself

Aryabhatta, आयर्
भठ - ancient Indian mathematician the astronomer laureate of India , who lived in the Post Vedic period. His dating is controversial but could be as early as 2500 BCE and if so is contemporaneous or even predates Babylonian mathematicians, see Aryabhata I

Arya,आयर् - is an adjective, meaning noble such as in Arya Putr, noble son or noble prince

Aryan, आयनर् - A term connoting the fictitious Aryan race, see also Vedics, should not be used synonymously with Aryan which has a racial connotation. Arya is purely a behavioral adjective and nothing more.
Aryan Race - A fictitious classification without any scientific basis used by the Europeans to distinguish themselves from the Semitic speaking people of the world. A word that has been foisted upon the Vedics who used the adjective Arya meaning of noble behavior. there was no racial connotation as there is now in Europe
Ashvamedha - A part of Rajasuya ritual performed by emperors to establish their sway over allies and neighboring kingdoms.

Asuras, असुर - Demons of the Vedic Hindus, linguistically cognate with Ahura (e.g. Ahura Mazda) in Zoroastrianism. Thus, while in Vedic religion the Asuras are demonic, in Zoroastrianism, the Ahura are benign. This inversion also applies to the other class of immortals: where the Vedic *devas* are benevolent, the Zoroastrian *daeva*s are malevolent. It is believed that this resulted in the Great schism between the Vedic Hindus and the followers of Zoroaster(**Dhrutarashtra**) who migrated west into what is Iran today.

Avidya, अिव - The state of ignorance which needs to be dispelled at the outset, before one can begin the journey in earnest towards self fulfillment and Moksha. 'Ignorance is bliss ' or so the satire goes. Ignorance most certainly is not bliss. It is one of the greatest sins a Hindu can commit. Avidya (pAra or apAra) is an unpardonable excuse and as soon as a person determines he/she is in a state of Avidya, they should take steps to remedy the situation.

Ayana - Course or journey; refers to the apparent direction of the suns course through the sky, uttarayana (north), dakshinaayana (south); cited in Sankalpam. Going, walking; road, path, way. Used in astronomy for advancing, precession; the sun's progress northward or southward, from one solstice to the other, is an ayana or half-year, two ayanas making one year. Also the equinoctial and solstitial points, the term for the solstice being ayananta. Finally, ayana signifies circulatory courses or circulations, as of the universe.

Ayanamsa - Ayanamsa is the Sanskrit term for the longitudinal difference between the tropical or Sayana and sidereal or Nirayana zodiacs. It is defined as the angle by which the sidereal ecliptic longitude of a celestial body is less than its tropical ecliptic longitude.

The sidereal ecliptic longitude of a celestial body is its longitude on the ecliptic defined with respect to the "fixed" stars. The tropical ecliptic longitude of a celestial body is its longitude on the ecliptic defined with respect to the vernal equinox point.

Since the vernal equinox point precesses westwards at a rate of 50".29 per year with respect to the fixed stars, the longitude of a fixed body defined with respect to it will increase slowly. On the other hand, since the stars "do not move" (this ignores the effect of proper motion) the longitude of a fixed body defined with respect to them will never change.

Ayanachalana -See Precession of the equinoxes (synonym kraantipaatagati)

Ayanaantha - Solstice

Ayanabhaaga - Amount of precession. i.e. arc of the ecliptic lying between the vernal equinox and the Indian zero point, synonym Ayanaaamsa

B

Bhakti Yoga, भिक्त - An approach to worship and spiritual practice in the Hindu tradition characterized by personal devotion to a divinity , often mediated by a holy person or teacher somewhat akin to the relationship with Christ among certain sects and adherents of Christianity

Bhartrihari, भतर्ृ -

िरहिरBhartrihari along with Panini and Patanjali who preceded him by several centuries is regarded as one of the main contrbutors to the field of linguistics in ancient India. He introduced the notion of shabda tattwa or shabda pramaanam, namely "the notion of the originary word (shabda) as transcending the bounds of spoken and written language and meaning. Understood as shabda tattva-the "word principle," this complex idea explains the nature of consciousness, the awareness of all forms of phenomenal appearances, and posits an identity obtains between these, which is none other than Brahman. It is thus language as a fundamentally ontological principle that accounts for how we are able to conceptualize and communicate the awareness of objects. The metaphysical notion of shabda Brahman posits the unity of all existence as the foundation for all linguistically designated individual phenomena

BhAshya, भाश्य -Commentary on a celebrated or scriptural work (e.g. Adi Sankara's BhAshya on the Bhagavad Gita)

Bhoodivas - A terrestrial day

Bhoogola - The sphere of the earth

Brahm-acharya - Or student life, when a boy lives with his teacher (Guru) and receives both religious and secular instruction. The youth is trained in self control, and acquires such virtues as chastity, truthfulness, faith, and self surrender

Brahmana, बर्ण -the correct pronunciation includes a short 'a' vowel at the end, the first 'a' is a long vowel while the second is a short one. The literal meaning is one who attains Brahman is a Brahmana - Brahavit Brahaiva bhavati - is the sruti and is the strict definition of a Brahmana. In this day and age it is difficult to fathom in a short period of time whether a particular person has realized Brahman or not. In such a circumstance one looks for adherence to the ethical values of the Hindu and whether the person has the qualities mentioned therein. One of the 4 varnas of society possessing a predominantly static guna amongst the three guNAs (Traigunya) rajas, tamas and satva. The Sanaatana Dharma strove to inculcate a meritocracy and recognizes everybody is not capable of meeting the same challenges. It is not a one size fits all ideology. The Dharma also recognizes there is diversity in the human species that not everybody can become a doctor or a star football player and that the person by reason of his guNAs may not have the inclination, fortitude and desire to put in the long years of training necessary to become a doctor. These differences are not necessarily related to ones appearance or even heredity but have to do with whether a person has the discipline, the single minded focus and fortitude to

undertake the arduous task of becoming a doctor or a Vedic priest or a star football player. Every fetus has the potential for fulfillment and Moksha but whether every single person rises to the demands of the tradition is a different matter, despite the fact that it is within the reach of each and every individual. In the modern era the Brahmana has adapted himself to the rigors and demands of a predominantly technological milieu and has filled many roles such as Doctor, Engineer, lawyer, Journalist, politician, think tank adviser, Professor, corporate executive, in addition to being a priest. Even so, the priestly Brahmana community remains one of the poorest in India today.

Brahmana, बर्ण -texts associated with each Veda

Brahmavidya,बर्ि‍व -Brahmavidya or Paravidya (metaphysics metaknowledge or higher knowledge) is the vehicle for attaining Moksha in the path known as Jnana Yoga and Yogasastra(the means to attain the same) is the practical discipline needed to attain Brahmavidya

Brahmanism - Brahmanism is an ersatz terminology used to describe Sanatana Dharma that has become popular in certain circles in the west. It is clear that the Dharma is a whole family of beliefs and darshanas. It has been thus since a very long time. The Vedic texts have survived several millennia of wars and natural disasters, but it is quite possible other texts have been lost. It has never been the contention of Hindus that the Vedas are the only canon to have originated in the Indian subcontinent. But it is clear that they are among the few to survive over the millennia. Furthermore the implication that Brahmanas had exclusive control over the content and practice of the faith is demeaning and insulting to the Sanatana Dharma which has had a longline of Rishis and Sages who have expounded on the faith few of whom have been Brahmanas. Belief systems that did not subscribe to the Vedic canon have been extant for a very long time and have been known as Nastik Dharmas and include among others Charvaka, Jainism and Buddhism. It is therefore unnecessary to invent a new word Brahmanism to describe an ancient faith which has a perfectly good name namely Sanatana Dharma. To use the word Rabbi-ism to describe the faith taught in Synagogues simply would not be accepted but forsome strange reason it is this peculiar has been foisted by the Occidental on the Indics to give the impression that it waa onlw qaonl a elite few hwop rapxticed it

Brahmi script बर्ी -Brahmi is a "syllabic alphabet", meaning that each sign can be either a simple consonant or a syllable with the consonant and the inherent vowel /a/. Other syllabic alphabets outside of South Asia include Old Persian and Meroïtic. However, unlike these two system, Brahmi (and all subsequent Brahmi-derived scripts) indicates the same consonant with a different vowel by drawing extra strokes, called *matras*, attached to the character. Ligatures are used to indicate consonant clusters. The Brahmi script was first deciphered by James
Princep although I find it difficult to believe that they could not find a single Indian who was capable of deciphering the Brahmi script.

Caste - Derived from Portuguese Casta, Caste has a meaning quite distinct from Varna which has been accepted as being part of the tradition. Caste according to the Portuguese means a race or a breed. Varna makes no such distinction and to ascribe racial motivations for a system based on division of labor depending on individual inclinations and which is a meritocracy to boot, is totally unconscionable, but that is exactly what the colonial power did with great success . The Sanatana Dharma makes no apologies for being a meritocracy based on competency and character and it is only after the advent of colonial rule that it took on the character of a racial and ethnic division based on birth. It is a tribute to the tenacity and persistence of the British that their viewpoint has prevailed and has been internalized by the Indic population for the most part. Yet it behooves those of us who know better to keep reminding everybody that the colonial viewpoint reflects a conjured up reality that has no relation to a core value nor is it derived from core beliefs held since antiquity. see also Varnashrama dharma.

Celestial (Equatorial)Coordinate System -the most commonly used astronomical coordinate system for indicating the positions of stars or other celestial objects on the celestial sphere . The celestial sphere is an imaginary sphere with the observer at its center. It represents the entire sky; all celestial objects other than the earth are imagined as being located on its inside surface. If the earth's axis is extended, the points where it intersects the celestial sphere are called the celestial poles; the north celestial pole is directly above the earth's North Pole, and the south celestial pole directly above the earth's South Pole. The great circle on the celestial sphere halfway between the celestial poles is called the celestial equator; it can be thought of as the earth's equator projected onto the celestial sphere. It divides the celestial sphere into the northern and southern skies. An important reference point on the celestial equator is the vernal equinox , the point at which the sun crosses the celestial equator in March. To designate the position of a star, the astronomer considers an imaginary great circle passing through the celestial poles and through the star in question. This is the star's hour circle ,

analogous to a meridian of longitude on earth. The astronomer then measures the angle between the vernal equinox and the point where the hour circle intersects the celestial equator. This angle is called the star's right ascension and is measured in hours, minutes, and seconds rather than in the more familiar degrees, minutes, and seconds. (There are 360 degrees or 24 hours in a full circle.) The right ascension is always measured eastward from the vernal equinox. Next the observer measures along the star's hour circle the angle between the celestial equator and the position of the star. This angle is called the declination of the star and is measured in degrees, minutes, and seconds north or south of the celestial equator, analogous to latitude on the earth. Right ascension and declination together determine the location of a star on the celestial sphere. The right ascensions and declinations of many stars are listed in various reference tables published for astronomers and navigators. Because a star's position may change slightly (see proper motion and precession of the equinoxes), such tables must be revised at regular intervals. By definition, the vernal equinox is located at right ascension 0 h and declination 0°.

Celestial equator,नाडिवृत्त Nadivruth,Nadivalaya - The great circle on the celestial sphere halfway between the celestial poles is called the celestial equator.

D

Dakshinayana - The southward journey of the Sun towards the Winter solstice, from its northernmost point during the Summer solstice usually identified as Dakshinayana Punyakala on July 16.

Dasha - Ten as in Dashaavatara,, the ten Avatars of Vishnu

Decimal system - see also place value system, decimal system [Latin= of tenths], numeration system based on powers of 10. A number is written as a row of digits, with each position in the row corresponding to a certain power of 10. A decimal point in the row divides it into those powers of 10 equal to or greater than 0 and those less than 0, i.e., negative powers of 10. Positions farther to the left of the decimal point correspond to increasing positive powers of 10 and those farther to the right to increasing negative powers, i.e., to division by higher positive powers of 10. For example,
4,309=(4x10**3)+(3x10**2)+(0x10**1)+(9x10**0)=4,000+300+0+9, and 4.309=(4x10**0)+(3x10**-1)+(0x10**-’2)+(9x10**-’3)=4+3/10+0/100+9/1000.

It is believed that the decimal system is based on 10 because humans have 10 fingers and so became used to counting by 10s early in the course of civilization. The decimal system was introduced into Europe c.1300. It greatly simplified arithmetic and was a much-needed improvement over the Roman numerals, which did not use a positional system. A number written in the decimal system is called a decimal, although sometimes this term is used to refer only to a proper fraction written in this system and not to a mixed number. Decimals are added and subtracted in the same way as are integers (whole numbers) except that when these operations are written in columnar form the decimal points in the column entries and in the answer must all be placed one under another. In multiplying two decimals the operation is the same as for integers except that the number of decimal places in the product, i.e., digits to the right of the decimal point, is equal to the sum of the decimal places in the factors; e.g., the factor 7.24 to two decimal places and the factor 6.3 to one decimal place have the product
45.612 to three decimal places. In division, e.g., 4.32 /12.8 where there is a decimal point in the divisor (4.32), the point is shifted to the extreme right (i.e., to 432.) and the decimal point in the dividend (12.8) is shifted the same number of places to the right (to 1280), with one or more zeros added before the decimal to make this possible. The decimal point in the quotient is then placed above that in the dividend, i.e., 432|1280.0 zeros are added to the right of the decimal point in the dividend as needed, and the division proceeds the same as for integers. The decimal system is widely used in various systems employing numbers. The metric system of weights and measures, used in most of the world, is based on the decimal system, as are most systems of national currency.

Dharma - one of the four kinds of human aspirations, which are dharma, artha, kAma and moksha. dharma: "Righteous living." The fulfillment of virtue, good works, duties and responsibilities, restraints and observances - performing one's part in the service of society. This includes pursuit of truth under a guru of a particular Parampara and sAmpradaya. Dharma is of four primary forms. It is the steady guide for artha and kama.

Dharma(Baudhik) - A central notion of Buddhism, used in various contexts;

1.The cosmic law, the great norm, underlying our world; above all the law of karmically determined rebirth

1 The teaching of the Buddha, who recognized and formulated this law; thus the teaching exdpresses the universal truth. The Dharma in this sense existed before the birth of the historical Buddha, who is no more than a manifestation of it. This is the Dharma in which the Buddhist takes refuge.

2 Norms of behavior and ethical rules.

4.Manifestation of reality, of the general state of affairs

Dravidian languages - An unverifiable hypothesis made to distinguish the languages of the south of India (Dravida) from those of the north. In reality, a Telugu speaking person , ostensibly a Dravidian language, can understand Sanskrit far more readily than even an accomplished scholar in sanskrit in the west. This despite the putative similarity between the European languages and Sanskrit.

Drkchaya - Parallax

Druhyu - One of 5 clans namely Anus, Druhyus, Turvashas, Puru, Yadu, the sons of Yayati. Druhyu is the 3rd son of Yayati. His dynasty is listed in Chapter 23 of the Bhagavata Puraana.The descendants of Druhyu eventually went on to become Zarathushtrans , followers of Zarathushtra(**Dhrutarashtra**) and subsequently formed the Aryamanush (Greek corruption Achaemenid) empire, e.g. Darius = Druhyu(Skrit) Daryavahyu (Persian) . Some of the ancient parsian kings belonging to the Aryamanush Dynasty

- **Haxamanish** or ACHAEMENES, first King of Persia, was mythical.
- **Teispes** c. 7th century BC. (this is the Greek version of the name)
- **Kurash I** (or CYRUS I) c. late 7th Century BC, son of Teispes.
- **Ariaramnes** c. late 7th century BC, son of Teispes.
- **Kambujia I** (or CAMBYSES I) ? - 559 BC, son of Kurash I.
- **Kurash II** (or CYRUS II) 559 - c. 550 BC when he became King of Kings, son of Kambuyia I.

For other Old Persian Sanskrit names see for instance,
http:/indicstudies.us/Archives/Linguistics/Persian names. I recommend all the readers of Indic origin (and others)use S'kritic names for Iranian kings. That will force us into a thought process that they were all a part of the Vedic civilization.

E

Ecliptic क्तां ु
तीवर्त**kraanthivruth** - the great circle on the celestial sphere that lies in the plane of the earth's orbit (called the plane of the ecliptic). Because of the earth's yearly revolution around the sun, the sun appears to move in an annual journey through the heavens with the ecliptic as its path. The ecliptic is the principal axis in the ecliptic coordinate system . The two points at which the ecliptic crosses the celestial equator are the equinoxes . The obliquity of the ecliptic is the inclination of the plane of the ecliptic to the plane of the celestial equator, an angle of about 23 1/2 °. The constellations through which the ecliptic passes are the constellations of the zodiac .

Ekadasi, एकाि दस - Ekadasi is the eleventh lunar day (Tithi) of the Shukla (bright) or Krishna (dark) Paksha (fortnight) respectively ,of every lunar month in the Hindu calendar (Panchanga).In Hinduism and Jainism, it is considered spiritually beneficial day. Scriptures recommend observing an (ideally waterless) fast from sunset on the day prior to Ekadasi until 48 minutes after sunrise on the day following Ekadasi. Ekadasi is a Sanskrit word, which means 'the eleventh'. It refers to the eleventh day of a fortnight belonging to a lunar month. There are two fortnights in a lunar month—the bright and the dark. So, Ekadasi occurs twice in a month, in the bright fortnight and the dark fortnight. The special feature of Ekadasi, as most people know it, is a fast, abstinence from food. This is how it is usually understood. In fact, the fast is only a practical expression and a symbol of something else that we are expected to do, which is of special significance to our personality.

Ephemeris , (*Plural* **ephemerides**) A table giving the coordinates of a celestial body at specific times during a given period. Ephemerides can be used by navigators to determine their longitude while at sea and by astronomers in following objects such as comets. The use of computers has allowed modern ephemerides to determine celestial positions with far greater accuracy than in earlier publications. **Ephemeris is** an astronomical almanac giving, as an aid to the astronomer and navigator, the locations of celestial bodies for each day of the year. The Ephemeris can be regarded as the Greek version of the Indain panchangam.

Epicycles - In the Ptolemaic system of astronomy, the epicycle (literally: on the circle in Greek) was a geometric model to explain the variations in speed and direction of the apparent motion of the Moon, Sun, and planets. It was designed by Apollonius of Perga at the end of the 3rd century BC. In particular it explained retrograde motion. Secondarily, it also explained changes in the distance of the planet from Earth.

Epistemology - The Theory of Knowledge is concerned with the means of acquiring knowledge. The root of the English word is the Greek word episteme meaning knowledge. This includes logical argument or reasoning, inference, testimony, and perception. All these words have precise equivalents in Sanskrit and the word for epistemology in Sanskrit is **Praamanya**, the theory of knowledge. The systematic study of the theory of knowledge goes back to great antiquity and

the names associated with these disciplines include among others Pannini, Patanjali. Yajnavalkya and Bhartrihari. It is our contention that most if not all of these savants lived in the millenium prior to the Christian era.

Equinox, vernal equinox वसंत संपत **,(Vasanth Sampat),autumnal equinox** - either of two points on the celestial sphere where the ecliptic and the celestial equator intersect. The vernal equinox, also known as "the first point of Aries," is the point at which the sun appears to cross the celestial equator from south to north. This occurs about Mar. 21, marking the beginning of spring in the Northern Hemisphere. At the autumnal equinox, about Sept. 23, the sun again appears to cross the celestial equator, this time from north to south; this marks the beginning of autumn in the Northern Hemisphere. On the date of either equinox, night and day are of equal length (12 hr each) in all parts of the world; the word equinox is often used to refer to either of these dates. The equinoxes are not fixed points on the celestial sphere but move westward along the ecliptic, passing through all the constellations of the zodiac in 26,000 years. This motion is called the precession of the equinoxes . The vernal equinox is a reference point in the equatorial coordinate system .
Equator - See Vishuvat

Exegesis - Exegesis (from the Greek ἐξηγεῖσθαι 'to lead out') is a critical explanation or interpretation of a text.

Biblical exegesis is a critical explanation or interpretation of the Bible. The goal of Biblical exegesis is to find the meaning of the text which then leads to discovering its significance or relevance.

Traditionally the term exegesis was used primarily for exegesis of the Bible. However in contemporary usage exegesis has broadened to mean a critical explanation of any text. The term is most often used for religious texts although it can be used for non-religious texts as well.

The critical aspects in doing exegesis covers a wide range of disciplines. Textual criticism is the investigation into the history and origins of the text. In addition there is an examination of the historical and cultural backgrounds for the author, the text, and original audience. Then there is a classification of the types of literary genre present in the text, and an analysis of grammatical and syntactical features in the text itself.

Sometimes the terms exegesis and hermeneutics have been used interchangeably. However, hermeneutics is a more widely defined discipline of interpretation theory. Hermeneutics includes the entire framework of the interpretative process, encompassing all forms of communication: written, verbal and nonverbal. Exegesis consists of interpretation principles that focus primarily on the written text.

F

Four noble truths ,आयर् सत्य **-(Baudhika)**

There is suffering (dukkha) in the world.
Suffering arises out of desire
It is possible to end suffering
The way to end suffering is to adopt the eightfold path (ashtaangika marga)
G
Gaudapada - Proponent of Advaita Vedanta and well versed in Buddhism. His most celebrated work is the Kaarika (Gloss)

on the Mandukya Upanishad

Gotra - A term applied to a clan, a group of families, or a lineage - exogamous and patrilineal - whose members trace their descent to a common ancestor, usually a Rishi of theVedic era. Atreya ,Bharadvaja ,Dhananjaya ,Gautam ,Haritasa ,Kaushika ,Kashyapa ,Kaundinya ,Kutsasa ,Lomash ,Mandvya ,Mouna Bhargava ,Mudgala Maudgalya, Moudgil, Modgil ,Parashara ,Sangar ,Sankyanasa ,Shandilya,Somnasser ,Srivatsa ,Upamanyu ,Vadula ,Vashishta ,Vatsa ,Veetahavya ,Viswamitra ,Yaska

Gregorian Calendar Reform

When Julius Caesar took power in Rome, the Roman calendar had ceased to reflect the year accurately. The provision of adding an intercalary month to the year when needed had not been applied consistently, because it affected the length of terms of office.

The Julian reform lengthened the months (except February, owing to its religious significance) and provided for an intercalary day to be added every four years to February, creating a leap year.

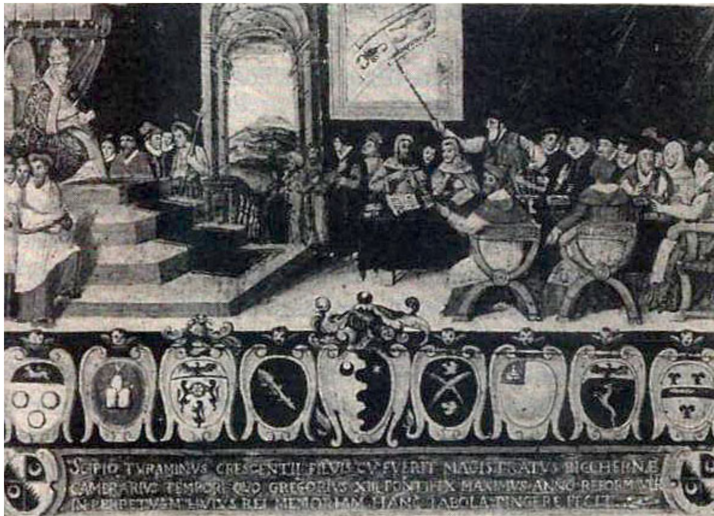
This produced a noticeably more accurate calendar, but it was based on the calculation of a year as 365 days and 6 hours (365.25 d). In fact, the year is 11 minutes and 14 seconds less than that. This had the effect of adding three-quarters of an hour to a year, and the effect accumulated. By the sixteenth century, the vernal equinox fell on March 10.



Pope Gregory XIII. Portrait by Lavinia Fontana

Pope Gregory XIII dedicated his papacy to implementing the recommendations of the Council of Trent. By the time he reformed the Julian calendar in 1582 (using the observations of Christopher Clavius and Johannes Kepler), it had drifted 10 days off course. To this day, most of the world uses his Gregorian calendar.

Under Pope Gregory XIII the leap rule was altered: century years, which are divisible by four, would not be leap years unless they are also divisible by 400. This makes the mean year 365.2425 days (365 d, 5 h, 49 min, 12 s) long. While this does not synchronize the years entirely, it would require 35 centuries to accumulate a day. This new calendar was synchronized with the traditional seasons again and was not applied to dates in the past, which caused a leap of at least ten days from the final day the Julian calendar was in effect. Thus the day after October 4 1582 was named October 15, 1582 and the 11 days in between are completely missing. This reform slowly spread through the nations that used the Julian calendar, although the Russian church year still uses the Julian calendar. The times varied so widely that some countries had to drop more than ten days: Great Britain, for instance, dropped eleven because the new Gregrpian calendar was adopted only in .



The Reform of the Calendar
Pope Gregory XIII Meets with His Calendar Commission, c. 1581

Reformers cite several problems with the Gregorian calendar:

- It is not perpetual. Each year starts on a different day of the week and calendars expire every year.
- It is difficult to determine the weekday of any given day of the year or month.

- Months are not equal in length nor regularly distributed across the year, requiring mnemonics (e.g. “Thirty days hath September…”) to remember which month is 28, 29, 30 or 31 days long.
- The year’s four quarters (of three full months each) are not equal. Business quarters that are equal would make accounting easier.
- Its epoch (origin) is not religiously neutral. The same applies to month and weekday names in many languages.
- Each month has no connection with the lunar phases.

It is impossible to solve all these issues in just one calendar.

$360 \div 7 = 51\frac{3}{7}$	$360 \div 12 = 30$
$364 \div 7 = 52 = 4 \times 13$	$364 \div 12 = 30\frac{1}{3}$
$365 \div 7 = 52\frac{1}{7}$	$365 \div 12 = 30\frac{5}{12}$
$366 \div 7 = 52\frac{2}{7}$	$366 \div 12 = 30\frac{1}{2}$

Most plans evolve around the solar year of little more than 365 days. This number does not divide well by seven or twelve, which are the traditional numbers of days per week and months per year respectively. The nearby numbers 360, 364 and 366 are divisible in better ways. There are also lunar centric proposals.

Grihastya - The second stage of the varna ashrama system,namely that of a householder ormarried man or woman.

Gunas - There are 3 Gunas , Sattwa, Rajas and Tamas and these three Gunas occur in each and every individual in varying degrees. The relative proportion of each in the total determines the essential nature of the individual. It follows that at any given time a individual, may exhibit different modes of behavior as his personality matures and develops. The son of a Brahmana may choose not to follow the priestly vocation and may elect to go into law. As a general rule of thumb one elects to be in a profession which utilizes his Gunas fully. For example Brahmanas tend to cluster around intellectual pursuits (teaching, legal, corporate management, administration etc. In the past the choice of professions available to Brahmanas were limited to priestly duties and the services he could render as a Minister to the Maharaja including mundane tasks such as accounting and cooking. In recent years substantial numbers of Brahmanas faced with increasing discrimination from their own government have elected to go into Business, so that his varna is that of a Vaisya, unless he maintains his competency and knowledge of the Vedic scripture and adheres to the injunctions of a Brahmana. Most Indian philosophers accept the view of the Samkhya philosophy when it refers to the definition of the Gunas and their relationship to Prakriti and Purusha.

Guna varna Vyavastha - The Varna system, namely Guna Varna Vyavastha, that produced the Varnashrama Dharma was conscious of the fact that this was the world's early attempt at a meritocracy. That the system was eminently successful in its own way , I have no doubt because the resulting civilization flourished for well over 5 millennia, until its very foundations were attacked by barbarians from both within and without; by barbarians, whose notion of entertainment was to build a pyramid of skulls, in order to terrorize the local population to capitulate. The current system in place after the colonial power was done reinventing and reshaping it to its own specifications, and which goes by the name Caste, is so utterly different in all significant ways, that we can safely say it has little to do with the Hindu faith or Hindu traditions such as the Guna Varna Vyavastha. The vedic division of people into 4 Varnas (Brahmana, Rajanya, Vaisya and Shudra) is by Guna and Guna only and is known as the Guna Varna Vyavastha. The Asrama system refers to the four stages of one's life, namely Brahmacharya (life of an unmarried student), Grihasthya (life of a householder), Vanaprasthaya (life of a retired householder), sannyasa (life of a monk)

H

Hinduism - Also known as Sanaatana Dharma, the eternal faith; there are roughly 900 million Hindus in the world as of 2008 (see Dharma)

Indo-Aryan languages - A family of languages spoken over a large area of the Eurasian land mass;see Indo-European Languages

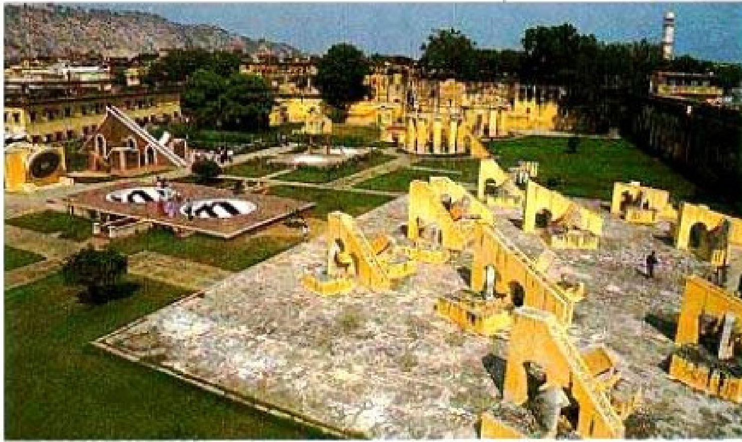
Indo-European languages - A family of languages spoken over a vast geographical area from India to most parts of Europe.
Indo-Iranian languages - the Indo Iranian branch of the Indo Europrean language family, spoken in central asia,iran and the Indian subcontinent
Indology - Indology is a name given by Indologists to the academic study of the history, languages, and cultures of the Indian subcontinent. Strictly speaking it encompasses the study of the languages, scripts of all of Asia that was influenced by Indic culture It may be surprising to learn that the first pioneer in Indology was the 12th Century Pope, Honorius IV. The Holy Father encouraged the learning of oriental languages in order to preach Christianity amongst the pagans. Soon after this in 1312, the Ecumenical Council of the Vatican decided that-"The Holy Church should have an abundant number of Catholics well versed in the languages, especially in those of the infidels, so as to be able to instruct them in the sacred doctrine." The result of this was the creation of the chairs of Hebrew, Arabic and Chaldean at the Universities of Bologna, Oxford, Paris and Salamanca. A century later in 1434, the General Council of Basel returned to this theme and decreed that –"All Bishops must sometimes each year send men well-grounded in the divine word to those parts where Jews and other infidels live, to preach and explain the truth of the Catholic faith in such a way that the infidels who hear them may come to recognize their errors. Let them compel them to hear their preaching." 1. Centuries later in 1870, during the First Vatican Council, Hinduism was condemned in the "five anathemas against pantheism" according to the Jesuit priest John Hardon in the Church-authorized book, The Catholic Catechism. However, interests in Indology only took shape and concrete direction after the British came to India, with the advent of the discovery of Sanskrit by Sir William Jones in the 1770's. Other names for Indology are Indic studies or Indian studies or South Asian studies. Political motivations have been always dominant in the pursuit of Indological studies right from the outset since the time of Sir William Jones, when he discovered the existence of Sanskrit. In fact the British presence in India was steadily increasing long before the Battle of Plassey in 1757 CE, but so great was the insularity of the colonial overlord that it took almost almost three hundred years for a scholar like Sir William to show up in India after Vasco da Gama landed of the cost of Goa in 1492 CE, and notice the similarities between Sanskrit and the european languages

Indus script - While several decipherments have been proposed including the recent work by Rajaram and Jha[131], it is possible the problem may never achieve a solution satisfactory to both the Indics and the Western indologists. Most Indics believe that this was the forerunner of the Brahmi script. The brahmi script is the progenitor of almost all of the languages and scripts of India and most of the rest of South East Asia .The BrahmI script has all of the phonetic characteristics to be found in all the successor scripts of Asia. To suggest a semitic origin for a Brahmi script is highly problematical since semitic scripts (including all the Roman scripts of Europe) do not have the characteristic Vowel strokes that Brahmi scripts have whenever a
vowel is appended to a consonant such as in आचायर् (the long 'a' vowel is represented by a vertical stroke). The name Brahmi suggests that the script was developed along the banks of the Sarasvati river, since Brahmi is synonymous with Sarasvati

[131] Rajaram, N . S., and N Jha, "The deciphered Indus script" .Aditya Prakashan, Delhi , 2005, ISBN 8177420151

Indus Valley Civilization or Harappan Civilization - AKA Sarasvati Sindhu Civilization (SSC), the civilization that endured for several millennia in the Sarasvati and Sindhu (Indus) river valleys the people who inhabited these valleys are also referred to as the Vedic Harappans by Bhagwan Singh. Most of the recent excavations indicate a heavy preponderance of settlements, about 400 in number on the banks of the dried up Sarasvatii river. Mohenjo Daro and Harappa represent a late phase of the civilization. European Indologists go to extraordinary lengths to make a distinction between the Vedic civilization and the SSC despite the fact they are located spatially and temporally in the same place and time. That they got away with this subterfuge for such a long time (it is still the official version of History in Indian text books) is a tribute to the farsightedness and tenacity of successive British administrators and scholars who always put British national interest before every other criterion including the truth. Their reasons for engaging in such intellectual dishonesty are chronicled in The South Asia File[132]
Iranian peoples - The ancient Iranians or Avestans, the people who composed the Avesta, have much in common with the Vedics. In fact it is believed by some that the Iranians are descended from the Druhyus. The language of the Avesta is easily discernible to those familiar with Sanskrit and the names of Persian Kings (the original names not the Greek version we learned in English history books) For instance the Sanskrit or Iranian version of Darius is Druhyu. It is surmised that a branch of the Bhrigu Rishi family, eventually composed the Avesta and that Dhritarashtra (Zoroaster) the founder of the Parsee religion, was a Bhrigu
J

Jantar Mantar
[132] The South Asia File,



A series of astronomical observatories built by Maharaja Jai Singh of Jaipur, the most well known of which is the one in Delhi. See for instance
http://www.crystalinks.com/indiastronomy.html

Jnana Yoga ज्नान -the path of knowledge Jñāna (also spelled "Gyāna"; Devanagari घ्यान) is the Sanskrit term for knowledge. In Hinduism it means true knowledge, PAra Vidya, the knowledge that one's self atman is Ultimate Reality Brahman. In Buddhism, it refers to pure awareness that is free of conceptual encumbrances, and is contrasted with Vijnana, which is a moment of 'divided knowing'. Jnana yoga is one path (marga) towards moksha (liberation), while Yoga offers different paths for different temperaments such as Bhakti and Karma Yoga.

Jivanmukta - Adi Sankara gives the true definition of a Jivanmukta - The great souls he says , calm and tranquil, live, regenerating the world like the spring; and themselves having crossed the ocean of embodied existence, and death, help those who struggle, for the same end, without the least trace of personal motives or advantage

Jyotisha - one of the 6 Vedangas, also known as the science of light .It includes the study of the motion of Celestial Objects or Astronomy and the effects of the forces arising from these bodies and their effects on the human mind. It is the hypothesis of Vedic Astrology that such effects can be predicted by studying the relative location of the planets and the stars . Jyotisha is often discussed as the instructional element of the Rig Veda, and as such is a Vedangas, or "body part" of the Vedas. Jyotisha is called the Eye of the Veda, for its believed ability to view both phenomenal reality and wisdom itself. Part of a larger Vedic curriculum including mathematics, architecture, medical and military applications. The author of this Vedanga is purported to be one **Lagadha**

K

Kalidasa, कालिदास -The poet laureate of ancient India. The author of the most widely known text and play Shakuntala

Kalpasutras - constitutes part of the Vedanga consists of Grhyasutras, Dharmasutras, Sulvasutras, Srautasutras.

KAma, काम - "Pleasure,desire,wish, love; enjoyment." Earthly love, aesthetic and cultural fulfillment, pleasures of the world (often used in the sense of sexual desire, but not necessarily so), the joys of family, intellectual satisfaction. Enjoyment of happiness, security, creativity, usefulness and inspiration. An essential ingredient for the emotional health of an individual and recognized as such by the ancient Vedics. Kama is one of the four Purusharthas or goals of life, the others being dharma , artha and moksha.

Kaarika - Gloss or explanatory text of an original text, such as the Kaarika of the Mandukya Upanishad by Gaudapada

Karma Yoga - Karma yoga, or the "discipline of action" is based on the teachings of the Bhagavad Gita, a holy scripture of Hinduism. One of the four pillars of yoga, Karma yoga focuses on the adherence to duty (dharma) while remaining detached from the reward. It states that one can attain Moksha (salvation) by doing ones duties in an unselfish manner. A great portion of the Bhagavad Gita is engaged in discussing the efficacy of various Yogas towards the goal of self realization or Moksha. Initially Arjuna is bewildered, when Bhagavan says that the Yoga of Knowledge is superior to the Yoga of action , even though desireless it may be. Why then do you ask me to fight asks an exasperated Arjuna of his friend and mentor, if such be the case. The answer by Bhagavan and elucidated by Adi Sankara in his Bhashya is one of the major insights of this lovely Celestial song. As explained by Adi Sankara, Karma Yoga consists of 4 principles 1. Giving up an

egoistic attitude (BG 18-46),2. Giving up the hankering for the fruits or results of one's action (BG 2-39), 3. Maintaining equanimity in the face of desirable andhappy circumstances as well as undesirable and not so pleasant situations (BG 2-48) 4. Surrendering of all actions as an offering to the Lord Ishwara) wholeheartedly (BG 3-33). It is possible to transcend Karma Yoga by the Yoga of Knowledge, which is in fact the superior approach, but such an alternative is not for every individual , and is best suited for those who have realized Brahman

Khagola - Celestial sphere or armillary sphere, a term used for both the geometrical celestial sphere as well as the astronomical instrument called the armillary sphere.

Kshatriya, क्षितर्य -the varna identified in the classical Indic tradition as those entitled to exercise military power and perform sacrifices, the dominant Guna in the Kshatriya varna is one of Rajas, and a passion for action. It is your Dharma to engage in action protect the aged and infirm and the children and women in your protection. It is better to follow ones own Dharma (dictated by ones Gunas) admonished Sri Krishna to Arjuna than to try something, however beguiling, which is not so suited

Kurgan - a region in Europe from where the putative emigration of the mythical Aryan race took place

Kushana Empire -

M

Madhavacharya - Celebrated religious teacher and scholar of the 14th century, one of the main teachers of the Dvaita-Vedanta school of pronounced dualism. It teaches the existence or permanent reality of two fundamental principles in universal nature: spirit and matter, or divinity and the universe. This dualism is in direct contrast with the unity doctrine taught in the Advaita-Vedanta or nondualistic system of Sankaracharya.

Mahavrata - winter solstice

Mahaavaakya, महावाक्य -

The 4 expressions that embody Vedanta, the essence of attaining Jivanmukta.

The Mahaavaakyas are the four "Great Sayings" of the Upanishads, foundational religious texts of Hinduism.

These four sayings encapsulate the central Truth of Hinduism.

The Mahaavaakya are:

1) *Prajnaanam Brahman* "Conscious is Brahman" (Aitareya Upanishad 3.3).

2) *Ayam Atma Brahman* "This Self (Atman) is Brahman" (Mandukya Upanishad 1.2)

3) *Tat Tvam Asi* - "That Thou art " (Chandogya Upanishad 6.8.7)

4) *Aham Brahmasmi* - "I am Brahman" (Brihadaranyaka Upanishad 1.4.10)

All four of these, in one way or another, indicate the unity of the individual human being with Brahman. Brahman is Absolute Reality, Cosmic Consciousness, the fundamental Primordial essence from which all divinities and all worlds arise and the Dharma asserts that each human being, in her or his innermost self, is this ultimate transcendent God-Reality. It is through practices like yoga, and meditation that the individual can realize her or his unity with the Divine and escape bonds of this world. The most forthright statement of the above proposition is to be found in texts propounding Advaita Vedanta. The Bhagavad Gita is one of the texts that enumerate the various paths one may take to attain Jivanmukta

Mananam - part of the process of gathering of knowledge using techniques such as sravanam,mananam and nididhyasanam. Mananam means to ponder over the material that one has read or heard

Metonic cycle (see also Adhikamaasa) - a cycle whereby every three years a lunar month is added to bring the lunar cycle in synchronization with the solar cycle. It turns out that it takes nineteen years to bring the two cycles in synchronization, so that a new moon occurs exactly on the same solar day that it did 19 years ago. When combined with the 4 year cycle used in the Julian calendar, yields a total cyclic time of 7*4*19 = 532 years, This is the time in years, that has to elapse in order for the same weekday to occur on the same date, for every month of th eyear. It is attributed to Meton, the Greek astronomer and now is credited to Babylonian astronomers, in the 5th century BCE, but should properly be credited to Yajnavalkya in the Satapatha Brahmana, who first postulated the 95 year old synchronization cycle. The higher number was necessitated by the greater accuracy of the observations and the greater accuracy that the Ancient Indics demanded in the final result

Mitanni - when the Hittite and the Mitanni (2 neighboring kingdoms in Anatolia, present day Turkey signed a treaty they invoked the blessings of their Gods . The invocation is addressed to the Nasatyas, Mitra and Varuna, Hindu Vedic deities from a distant past

Moksha -"Liberation." Is synonymous with Freedom from rebirth through the ultimate attainment, realization of the Self God, PArasiva. The spiritual attainments and superconscious joys, attending renunciation and yoga leading to Self Realization. Moksha comes through the fulfillment of dharma, artha and kAma (known in Tamil as aram, porul and inbam, and explained by Tiruvalluvar in Tirukural) in the current or past lives, so that one is no longer attached to worldly joys or sorrows. It is the supreme goal of life, called paramartha. This is a distinction between the DhArmic traditions originating in the Indian subcontinent from the very earliest time periods in history and other religious belief systems. The propensity to cater to the higher needs (in the Maslow hierarchy) from the very inception of the tradition is a uniquely Indic development. Merely to emphasize this as a spiritual characteristic is to mnimize the pragmatic and psychological needs of the human species . Paying special attention to the fulfillment of these needs is a distinctive characteristic of Indic dharma.

Mumukshutwa - An intense thirst for Brahmavidya or higher knowledge (Paara Vidya)

N

Nakshatras - The concept of positing 27 Nakshatras in the sidereal zodiac goes back to antiquity at least in India. The ancients divided the sky in 27 or 28 lunar mansions or Nakshatras, characterized by asterisms (apparent groups of stars), one for each day that the Moon follows its track among the stars.

Naksatra-vidya - The astronomical aspect of Jyotisha (which includes Astrology

Nididhyasanam - the final step of the 3 step process of sravanam, mananam, nididhyasanam, involves deep meditation and requires mumukshutwa and titiksha

Nirukta - this treatise was authored by Yaska and deals with Etymology , a branch of Linguistics, the study of the roots of all words, made simpler by the intentional highlighting of Dhaatu in sanskrit. Yaska is one of the bright galaxy among the plethora of broad spectrum philosophers in the ancient Vedic era, who counted numerous skills in their repertoire linguistics being just one of their many fields of expertise

Nighantu - Yaska's Vedic Glossary,Nirukta is a commentary on the Nighantu

Nirvana - blown out or extinguished as in the case of a lamp. Nirvana is generally used to refer to a material life that has been extinguished, i.e. for one who has achieved freedom from rebirth. The term Nirvana is commonly used in Buddhism as the final stage a practitioner strives for . The word does not mean heaven and is analogous to Moksha in the Sanaatana dharma

Nischitaaartham, िनिस्चताथमर् - Engagement ceremony prior to a wedding. Literally means 'firming up' of the relationship and is usually commemorated with a Puja and an exchange of rings, gifts and invitations to the wedding ceremony .

Nyc`the´me`ron

n. 1. The natural day and night, or space of twenty-four hours.

Webster's Revised Unabridged Dictionary, published 1913 by C. & G. Merriam C

P

Pancha – sanskrit term for five e.g. Panchabana,panchatantra

Parampara,परंपरा -tradition,as in likhita Parampara (written tradition), srauta **Parampara** (oral tradition), guru Parampara, (the guru-disciple tradition)

Place Value System,स्थान -the most common Sanskrit word for this is sthana which literally means place, and refers to the decimal system of numbers where the value of a number is determined by its location with respect to other numbers to the right , e.g. 3 followed by a 0 , means the number is thirty

Perigee - the point in the orbit of an object (as a satellite) orbiting the earth that is nearest to the center of the earth ; *also* **:** the point nearest a planet or a satellite (as the moon) reached by an object orbiting it — compare apogee

Poornima,पू
िनम - full moon

Pope Gregory XIII (Ugo Bioncompagni,1502 – 1585)sent missionaries to India (and China) mainly to learn from the Namputhiris of Kerala. He suppressed knowledge that did not agree with thre church dogma and also issued a proclamation that no knowledge,, regardless of its source, be attributed to other than Catholics. In other words he flouted the concept of intellectual property with impunity. The Gregorian Calendar was fixed shortly thereafter (the return of the Jesuits from Malabar.

Purana, पु -literally means the ancients. Traditional sanskrit texts dealing with diverse

राण
topics such as the creation of the world ,legends, genealogy of sovereigns, In the Indic context, puranas have special significance both from a temporal stand point and from a historical perspective

Purusha, Paurusheya, Apaurusheya - In Hinduism, Purusha ("Cosmic Man") is the "self" which pervades the universe. The Vedic divinities are considered to be the human mind's interpretation of the many facets of Purusha. According to the Rigvedic Purusha sukta, Purusha was dismembered by the devas -- his mind is the moon, his eyes are the sun, and his breath is the wind.In Samkhya, a school of Hindu philosophy, Purusha is pure consciousness. It is thought to be our true identity, to be contrasted with Prakrti, or the material world, which contains all of our organs, senses, and intellectual faculties.Amore restrcted meaning of purusha is youth or human (paurusheya).Hinduism in that sense is an Apaurusheya belief system as opposed to the revealed or prophetic faiths such as Judaism,Christianity or Islam which would therefore come under the category of paurusheya religions

PurushArtha - PurushArtha or ManushyArtheha is the pursuit of the four kinds of human aspirations, which are dharma, artha, kAma and moksha. The four pursuits in which humans may legitimately engage, also called chaturvarga, "four-fold good" , is a basic principle of Hindu ethics.

Purvapaska -new moon to full moon period

PramAnam, Epistemology पर्माणम -the process of gaining knowledge, sometimes used to express the goal as well as the means to attain knowledge, as in Apaurusheya PramAnam

PrAsthanatrAyi - Prasthanatrayi, literally, three points of departure, (IAST Prasthānatrayī) refers to the three canonical texts of Hindu philosophy, especially the Vedanta schools. It consists of: the anishads, known as Upadesha prasthana (injunctive texts),the Brahma Sutras, known as Nyaya prasthana (logical text),the Bhagavad Gita, known as Sadhana prasthana (practical text)

Pratyaksha, ्रत्यक्ष -*Prathyaksha pramaana:* This is called direct proof, as it is perceived by the sense organs. These organs are only instruments. The mind enters them and helps them to function. There are some limitations on the senses like disease and imperfection, that make proof obtained by this method to be infirm. For example, a normal eye can see all colors, a jaundiced eye sees everything as yellow. Though the *laddu* is sweet, the tongue of a malaria patient classifies it as bitter. Here, there are two points of view. From the point of view of the matter it is sweet. But from the point of view of the senses it is bitter. It can be concluded, therefore, direct proof is not complete evidence for real justice.

Precession of the Equinoxes (see also Ayanachalana)see also equinox - The earth revolves around the Sun once in 365 days 5 hours 48 minutes and 46 seconds. Considered from the earth, the Sun appears to complete one round of the ecliptic during this period. This is called a tropical year .In the span of a tropical year, the earth regains its original angular position with the Sun. It is also called the year of seasons since on this Earth-Sun cycle depends the occurrence, and timing, of seasons. If we consider the revolution of the Sun around the earth from one vernal equinox (around 21st March, when the day and night all over the globe are equal) to the next vernal equinox, it takes one tropical year to do so. However, if at the end of a tropical year from one vernal equinox to the next, we consider the position of the earth with reference to a fixed star of the zodiac, the earth appears to lie some 50.26 seconds of celestial longitude to the west of its original position. In order for the earth to attain the same position with respect to a fixed star after one revolution, it takes a time span of 365 days 6 hours 9 minutes and some 9.5 seconds. This duration of time is called a sidereal year .The sidereal year is just over 20 minutes longer than the tropical year. Each year, the Vernal equinox will fall short by 50.26 seconds along the zodiac reckoned along the fixed stars. This continuous receding of the Vernal equinox along the zodiac is called the Precession of the equinoxes.

Proto-Indo-European - PIE for short is a constructed language for which there is no existence theorem . It is based on unproven hypothesis

Proto Dravidian - the alleged hypothetical ancestor language to the modern languages of Telugu, Tamil, Kannada, Tulu and Malayalam. Again there is no proof that a single human ever spoke the language. There is no reference to such a language in any of the vast literary works of India south or north.

R

Rajas - Raajasik individuals are filled with a desire and passion to undertake new projects and goad others into action. Many leaders exhibit a Raajasik temperament

Raja Yoga - Raja Yoga, as outlined by Patanjali, describes eight "limbs" of spiritual practices, half of which might be classified as meditation. Underlying them is the assumption that a yogi should still the fluctuations of his or her mind: *Yoga cittavrrti nirodha.*

Ramayana - a Hindu epic in which Rama, avatar of Vishnu vanquishes Ravana and is reunited with his spouse Seetha
Rig Veda - The earliest and the most prominent of the Vedas, the compositions of the Ancient Indics who we will refer to also as the Vedics,held to be sacred and termed Sruti by many Hindus, the chief characteristic was their oral tradition
Roma_people - The name that the Gypsies are known by in Europe, reflecting their large numbers in Romania
S

Sampradaya, सां -In Hinduism, a SAmpradaya is a tradition encompassing a common

पर्दाय

philosophy but embracing many different schools, groups, or guru lineages (called *parampara*). By becoming initiated (diksha) into a parampara one automatically belongs to its proper sAmpradaya.

Sankaracharya, संर्

कराचाय -The great proponent of Advaita Vedanta. Bhagavatpada Acharya Sankara was a veritable institution masquerading as an individual There is controversy over the date of his birth, ranging from 509 BCE to 788 CE

Saankhya, सां -Saamkhya is considered to be the oldest among the philosophical systems

ख्य

dating back to about 7c BC. Kapila, the author of 'Saamkhya Sutra", is considered to be the originator of this system. The "Saamkhya Karika" of Ishwarakrishna is the earliest available text on Saamkhya dating to about 3c AD. Saamkhya's name is derived from root word Saamkhya (enumeration) and is reflective than authoritative. Well-known commentaries are Gaudapada's bhasya, Vacaspati Misra's Tattwa-kaumudi, Vijnanabhiksu's Saamkhya-pravacanbhasya, and Mathara's Matharavrtti.
The Saamkhya system proposes the theory of evolution (prakriti-purusha) that is accepted by all other systems. The purusha (soul) of this system is unchanging and is a witness to the changes of prakriti. Hence the Saamkhya system is based on dualism wherein nature (prakriti) and conscious spirit (purusha) are separate entities not derived from one another. There can be many purushas since one man can attain enlightenment while the rest do not, whereas prakriti is one. It is identified with pure objectivity, phenomenal reality, which is non-conscious.
Prakriti possess three fundamental natures; (1) The pure and fine Sattva (2) the active Rajas and
(3) the coarse and heavy Tamas. Sattva accounts for thought and intelligibility, experienced psychologically as pleasure, thinking, clarity, understanding and detachment. Rajas accounts for motion, energy and activity and it is experienced psychologically as suffering, craving and attachment. Tamas accounts for restraint and inertia. It is experienced psychologically as delusion, depression and dullness.
The conscious Purusha excites the unconscious Prakriti and in this process upsets the equilibrium of the various gunas. According to Saamkhya there are twenty-five tatvas which arise due to the union of purusha and prakriti. Their union is often described as the ride of a lame man with perfect sight (purusha) on the shoulders of a blind person of sure foot (prakriti). Their process of evolution is as given below and it accounts for the different tatvas. In Saamkhya creation is the development of the different effects from mulaprakriti and destruction their dissolution into mulaprakriti.
Saamkhya is essentially atheistic because it believes that the existence of god cannot be proved. Prakriti, the cause of evolution of world, does not evolve for itself but for Purusha-the ultimate consciousness. The self is immortal but due to ignorance (avidya) it confuses itself with the body, mind and senses. If avidya is replaced by vidya the self is free from suffering and this state of liberation is called kaivalya. Yoga is the practical side of Saamkhya.

Sanskrit, Samskrtam सं -Sanskrit (संsaṃskṛtam).The adjective saṃskṛta

स्कर्तमस्कर्तम

means "refined, consecrated, sanctified". The language referred to as saṃskṛtā vāk "the refined language" has by definition always been a 'high' language, used for religious and scientific discourse and contrasted with the languages spoken by the people.

Saptarishi, सिरिश -The Ursa Major constellllation. The Saptarishi play a major role in Hindu astronomy A number of yugas In Hindu philosophy, the cycle of creation is divided into four Yugas (ages.): Satya Yuga or Krita Yuga Treta Yuga Dwapara Yuga Kali Yuga make a manvantara Each manvantara has a set of seven rishis who help in preserving order and propagating knowledge in that manavantra.Bharadwaja is one of the seven rishis of the Vaivasvata Manavantra. The other six rishis of the Vaivasvata manavantra are Atri an Hinduism, Atri is a legendary bard and scholar, and a son of Brahma. Jamadagni, is the father of Parashurama, one of the avatars of Vishnu. King Kaartaveerya Arjuna and his army visited Jamadagni, who fed his guest and the whole army with his divine cow; the king demanded the cow and Jamadagni refused

because he needed the cow for his religious ceremonies. King Kaartaveerya Arjuna sent his soldiers to take the cow and Parashurama killed the entire army and the king with his axe (given to him by Shiva). In return, the princes beheaded Jamadagni. In revenge, Parashurama destroyes large numbers of the Kshatriyas.
Brahmarishi Viswamitra is one of the seven venerated sages of Hindu mythology. He is a kshatriya (Warrior caste) by birth, but has transcended into the brahmin priestly caste with his tough penance.
Vasishta, in Hindu mythology was chief of the seven venerated sages (or Saptharishi) and the Rajaguru of the Solar Dynasty. He was famous for subduing the armies of Viswamitra. He had in his possession the divine cow Nandini who could grant anything to her owner.
Gauthama and Kashyapa: Kashyapa ("tortoise") is an ancient god (one of the rishis), father of the devas, asuras, nagas and all of humanity. He is married to Aditi, with whom he is the father of Agni and the Adityas. He received the spoils of Parasuma's conquest of King Kaartaveerya Arjuna.

Sapta Saindhava , स सै

न्घव **–** Land of the seven rivers has been generally identified as Punjab by the modern scholars. Rulers of the western lands, the Druhyus and the Anus, preserved the Rig Veda and helped the Puru Bharats in building a Dhaarmic empire

Sattva,सत्व - Individuals who are predominantly Sattvic are attached to happiness and to knowledge

Satya,shuddhi -truthfulness in thought and speech

Shaastra or ShAstra or sastra शा -ShAstra is a Sanskrit word used to denote education/knowledge in a general sense. The word is generally used as a suffix in the context of technical or specialised knowledge in a defined area of practice. For example, Astra shastra means, knowledge about "Handling of weapons", Astra means weapons, and Shastra is their knowledge.Extending this meaning, the shastra is commonly used to mean a treatise or text written in explanation of some idea, especially in matters involving religion. In Buddhism, a shastra is often a commentary written at a later date to explain an earlier scripture or sutra.In the Indonesian language, 'sastra' is a word meaning 'literature'.

shabda pramaanam (Bhartrihari) See Bhartrihari

Shatapatha Brahmana,शतपथ बर्:मण

Shatapatha Brahmana (शतपथ बर्ाण, Brahmana of one-hundred paths) - is one of the prose texts describing the Vedic ritual. It belongs to the *vājasaneyi madhyandina shakha* of the White Yajurveda. It survives in two recensions, Madhyandina and Kanva, with the former having the eponymous 100 brahmanas in 14 books, and the latter 104 brahmanas in 17 books. Linguistically, it belongs to the Brahmana period of Vedic Sanskrit, dated by Western Indologists to the first half of the 1st millennium BC. Hindu scholars have dated it to around 1800 BC, based on the reference in it of migration from the Sarasvati river area to east India, because the river is said to have dried up around 1900 BC. The 14 books of the Madhyandina recension can be divided into two major parts. The first 9 books have close textual commentaries, often line by line, of the first 18 books, of the corresponding Samhita of the Yajurveda. The following 5 books cover supplementary and ritualistically newer material, besides including the celebrated Brihataaranyaka Upanishad as most of the 14th and last book. The celebrated author of the Shatapatha brahmana is reputed to be **Yajnyavalkya** himself. He is also reputed to have made the observation that the the 95 year synchronization cycle provides an accurate measure of the repeatability of lunar phenomena. The Shatapatha Brahmana was translated into English by Prof. Julius Eggeling, in the late 19th century, in 5 volumes published as part of the Sacred Books of the East series. Retrieved from
"http://en.wikipedia.org/wiki/Shatapatha_Brahmana"

Shakti,िशक्त - the female energy principle, in the Indic tradition ,the primordial icon of strength and energy is associated with the feminine gender

Shaanti - peace of mind attained through the disciplines of Raja Yoga **Shaucha** - cleanliness

Sidereal Day - Nakshatra divas, a mean sidereal day is about 23h56m in length. Due to variations in the rotation rate of the Earth, however, the rate of an ideal sidereal clock deviates from any simple multiple of a

Sidereal Month - Sidereal month The actual period of the Moon's orbit as measured in a fixed frame of reference is known as a sidereal month, because it is the time it takes the Moon to return to the same position on the celestial sphere among the fixed stars (Latin: sidus): 27.321 661 days (27 d 7 h 43 min 11.5 s) or about 27 ⅓ days. This type of month has appeared among cultures in the Middle East, India, and China in the following way: they divided the sky in 27 or 28 lunar mansions, characterized by asterisms (apparent groups of stars), one for each day that the Moon follows its track among the stars.

Sidereal Time - During the course of one day, the earth has moved a short distance along its orbit around the sun, and so must rotate a small extra angular distance before the sun reaches its highest point. The stars, however, are so far away

that the earth's movement along its orbit makes a generally negligible difference to their apparent direction (see, however parallax), and so they return to their highest point in slightly less than 24 hours. A mean sidereal day is about 23h56m in length. Due to variations in the rotation rate of the Earth, however, the rate of an ideal sidereal clock deviates from any simple multiple of a civil clock.

Sidereal Year - In order for the earth to attain the same position with respect to a fixed star after one revolution, it takes a time span of 365 days 6 hours 9 minutes and some 9.5 seconds. This duration of time is called a sidereal year .The sidereal year is just over 20 minutes longer than the tropical year; this time difference is equivalent to 50.26 seconds of celestial longitude.Each year, the Vernal equinox will fall short by 50.26 seconds along the zodiac reckoned along the fixed stars. It

Smrti,स्मर्ित - that which is remembered, . There are a number of texts that are specifically classed as smrti and are mostly named after the name of the rshi expounded on the smrti such as Parashara smrti, Manu smrti and Yajnavalkya smrti

Solar Day - Solar time is measured by the apparent diurnal motion of the sun, and local noon in solar time is defined as the moment when the sun is at its highest point in the sky (exactly due south in the northern hemisphere and due north in the southern hemisphere). The time taken for the sun to return to its highest point is exactly 24 hours, or a solar day.

Sramana tradition - A śramaṇa is one who performs acts of mortification or austerity. According to the definition, a being is himself responsible for his own deeds. Salvation, therefore, can be achieved by anybody irrespective of caste, creed, color or culture. The cycle of rebirth to which every individual is subject is viewed as the cause and substratum of misery. The goal of every person is to evolve a way to escape from the cycle of rebirth, namely by discounting ritual as a means of an emancipation and establishing from the misery of Saṃsāra, through pious religious activities.. The term has been used in the past as a synonym for the Baudhik tradition

Srautasutras - Srauta is the adjectival form of Sruti (that which is heard)and is one of the 4 constituent sutras in the Kalpasutra (see also Sulvasutra)

Sravanam,शर्वणम - Comes from the same root as shruti. Essentially means learning by listening. Sravanam, mananam, nididhyasanam is the 3 step process towards Brahma vidya and self realization. In reality it is the approach generally adopted to the study of most subjects especially those with complex concepts

Sruti,शर्ु

ित - that which is heard as opposed to that which is remembered (smrti). The smrti were composed by famous rishis and we have

Sulvasutras,सु्ू -The Sulvasutras (or Sulbasutras) or aphorisms of the cord

ल्वसतर्

(measurements were made using a string stretched between 2 pegs). The resulting mathematical manipulations needed to solve the problems of finding areas and volumes of reasonably complex shapes formed the subject matter of the Sulvasutras. The Sulvasutras were part of the KalpaSutra appendices to the Veda. KalpaSutra consisted of Grhyasutras, Srautasutras, Dharmasuturas and Sulvasutras. The KalpaSutras in turn are part of the Vedanga (limbs of the Veda) comprising of Chandas (meter), Nirukta(etymology), Vyakarana Grammar, Jyotisha (Astronomy and astrology) and Kalpasutras.0ne set of such Sutras are the Kalpa Sutras which consisted of Srauta Sutras, Dharma Sutras, Grihya Sutras and Sulva Sutras. The Srauta Sutras give elaborate rules for the performance of Vedic sacrifices; the Grihya Sutras deal with domestic religious ceremonies; the Dharmasutras contain the rudiments of Hindu Law and the Sulva Sutras form the earliest source of Hindu Mathematics

Suryaprajnapati - A Jaina astronomical treatise ,which uses a 5 year lunisolar cycle. One of the great contributions of the Jainas to Astronomy and Mathematics in Ancient India. The Jaina tradition exhibited a very superior knowledge of the exact sciences when compared to similar civilizations of that period.

Surya-Siddhanta (Sanskrit) (SS) A celebrated astronomical and cosmogonical work of ancient India of enormous antiquity. This work shows marvelous mathematical skill and comes very close to the modern time periods of astronomy that the most skilled mathematicians and astronomers have determined. It also deals with yugas in their various lengths, divisions of time itself into infinitesimal quantities, and general astronomical subjects, including not only the time periods of the sun, moon, and planets, but also eclipses, seasons of the year, etc.

The *Surya-Siddhanta* states that it was dictated more than two million years ago, towards the end of the krita yuga (golden age) by the sun himself, through a projected solar representative, to the great sage Asuramaya who wrote down the revelation. It was known to Aryabhata and Varahamihira

T

Tamas - Tamas is inertia born of ignorance. It enshrouds the discrimination of man and inclines him to indolence, sleep and renders him inert. By nature it is destructive

Terminus post quem : *Terminus post quem* **and the related** *terminus ante quem* **are terms used to give an approximate date for a text.** ***Terminus post quem*** **is used to indicate the earliest point in time when the text may have been written, while** ***Terminus ante quem*** **signifies the latest date at which a text may have been written.**

Terminus ante quem refers to the date **before which** an artifact or feature must have been deposited. Used with *Terminus post quem* ("limit after which"), similarly, *terminus ad quem* ("limit to which") may also refer to the latest possible date of a non-punctual event (period, era, etc.), while *terminus a quo* ("limit from which") may refer to the earliest such date.

For example an archaeological find of a burial may contain coins dating to 1588, 1595 and others less securely dated to 1590-1625. The *terminus post quem* would be the latest date established with certainty, the coin that may have only reached circulation in 1595. The burial can only be shown to be 1595 or later. A secure dating of another coin to a later date would shift the *terminus post quem*.

An archaeological example of a *terminus ante quem* would be deposits formed before or beneath a historically dateable event, such as a building foundation partly demolished to make way for the city wall known to be built in 650. It may have been demolished in 650, 649 or an unspecified time before - all that can be said from the evidence is that it happened before that event.

Either term is also found followed by Latin *non* **not**. An example is in the supposed language dating method known as linguistic palaeontology. This holds (very controversially) that if the ancestor language of a family can be shown to have had a term for an invention such as the plough, then this sets a *terminus ante quem non*, a time-depth *before* which that ancestor language could *not* have begun diverging into its descendant languages. This has been used to argue against the Anatolian hypothesis for Indo-European because the date it implies is too early in that it violates the *terminus ante quem non*.

Tithi/ Lunar Day - The area covered by the Moon in its transit away from the Sun, computed for the moment of its conjunction with Sun to its true longitude at the moment of the epoch. It is obtained by subtracting the Longitude of the Sun from the longitude of the Moon. A tithi is completed when the longitude of Moon gains exactly 12 degrees or its multiple on that of Sun and therefore there are 30 tithis in a lunar month. Is the root of the word atithi which means Guest in sanskritam (meaning one who may show up at any time or day but should be welcomed regardless http://en.wikipedia.org/wiki/Tithi

Titiksha (Sanskrit) - [from the verbal root *tij* to urge, incite to action, be active in endurance or patience]**.**Patience, resignation, endurance; not mere passive resignation, but an active attitude of patience in supporting the events of life. Mystically, the fifth state of raja yoga -- "one of supreme indifference; submission, if necessary, to what is called 'pleasures and pains for all,' but deriving neither pleasure nor pain from such submission -- in short, the becoming physically, mentally, and morally indifferent and insensible to either pleasure or pain" (VS 93). The meaning however is not of a cold, heartless, impassive attitude towards the sufferings of others, but an active positive attitude, so far as one's individual pleasures or pains are considered, but likewise involving an active attitude of compassion for the tribulations and sufferings of others. The same thought is involved in the title Diamond-heart, given to adepts: as hard and indifferent to one's own sorrows as the diamond is hard and enduring, yet like the diamond reflecting in its facets as in mirrors the sufferings and sorrows of all around.

Also personified as a goddess, the wife of Dharma (divine law) and daughter of Daksha.

Tocharia -A people who lived in the Tarim basin of current day China, and who spoke a Indo European language

U

Upanishads - Of the one hundred and eight extant Upanishads sixteen were recognized by Adi Sankara as authentic and authoritative. In his commentary on the Vedanta Aphorisms he included quotations from six. On the other ten he wrote elaborate commentaries. It is these ten which...have come to be regarded as the principal Upanishads: Isa, Kena, Katha, Prasna, Mundaka, Mandukya, Chandogya, Brhadaranyaka, Aitareya, and Taittiriya."

Urheimat - A postulate that the Proto Indo European people (another postulate) originally lived in a common homeland or Urheimat at some distant past. While this is a very beguiling assumption, there is absolutely no evidence in Archaeology of such a Urheimat. It is purely a hypothetical construct only of academic interest. See the translations of the passages from the Rg quoted in the section on AIT, in the context of the discussion on the debate of the origin of the Vedic people.

Uttarayana - The Sun's northward journey, as viewed from the earth) from winter solstice (shortest daylight hours) to summer solstice (the longest day in the calendar). Usually celebrated throughout India as Makara Sankranti and Pongal .

It i s interesting that this is celebrated as occurring in Makara when we know that the Winter solstice occurs within a day or so of December 22. The answer liews in the fact that , the precession of the equinoxes (and the solstices) has changed the date of the solstice from January 15 to December 22. This in fact tells us that the date when this festival was delineated was about 1600 years ago. Obviously, the winter solstice no longer occurs in Makara .

Vaisya - One who benefits humanity by his efforts and specialization in trade, commerce and agriculture. The commercial sector of society.

Varna asrama dharma - The system, namely Guna Varna Vyavastha, that produced the Varnashrama Dharma was conscious of the fact that this was the worlds early attempt at a meritocracy. That the sytem was eminently successful in its own way , I have no doubt because the resulting civilization flourished for well over 5 millennia, until its very foundations were attacked by barbarians from both within and without by Barbarians, whose notion of entertainment was to build a pyramid of skulls, in order to terrorize the local population to capitulate. The current system in place after the colonial power was done reinventing and reshaping it to its own specifications, and which goes by the name Caste, is so utterly different in all significant ways that we can safely say it has little to do with the Hindu faith or Hindu traditions such as the Guna Varna Vyavastha

Vedanga Jyotisha (VJ) , the earliest codified texts of ancient India, and consists of the Rig Jyotisha,(RJ) the Atharva Jyotisha(AJ) and the Yajusa Jyotisha(YJ) . The RJ consists of 36 verses and the YJ consists of 44 verses and the authorship of these two is ascribed to Lagadha

Vedic civilization - the civilization of the people who composed the Vedas and the vast literature of cosmic proportions associated with the SanAtana Dharma

Vedics or the Vedic people - the people who composed the Vedas and their Universe of allies and adversaries

Vedic Saraswati River - The Saraswati river is mentioned in several verses in the Rg at least 50 times as a river flowing from the mountains to the sea. Satellite data has shown evidence of a dried up river bed. Some examples of these quotations are given in the AIT page,http://www.indicethos.org/AIT/. All the AIT and their progeny ignore this significant fact. It is as if the relevance of the reference to the Saraswati is of no significance at all an dif they do dewign to acknowledge the reference to the Sarasvati they claim it is small stream in Afghanistan that never reaches the sea. Reminds one of Oliver Goldsmiths Village Schoolmaster, ‘where even though vanquished he could argue still.

Vernal Equinox - see equinox

Vikshepa, kshepa - Celestial latitude , the angle between the celestial equator and the position of the star, measured in the plane of the great circle. This angle is called the declination of the star and is measured in degrees, minutes, and seconds north or south of the celestial equator, analogous to latitude on the earth.

Vishnu,िवु -sustainer of the Universe, whose Avatars came down to earth from time to time to reestablish order in the universe.the Srimad Bhaagavatam is a chronicle of the avatars of Vishnu

Visuva -spring equinox

Visuvant - summer solstice

Vishuvat, िवशु -Equator

वत

Vivaaha,िववाह् - marriage ceremony

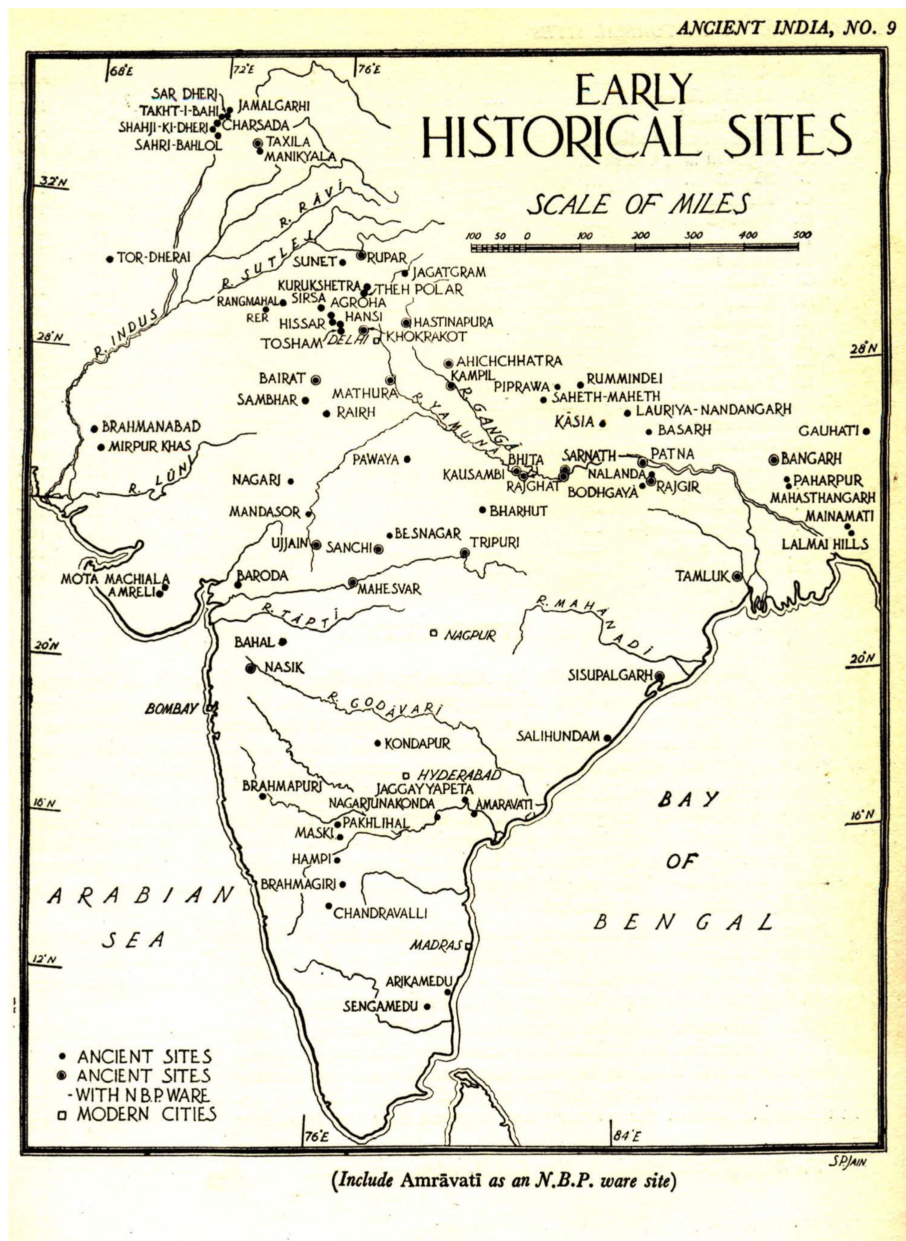
Y

Yogasastra, योगशा -The means to attain Moksha or Self Realization , a knowledge of Metaphysical aspects of the human consciousness

Yuezhi - the Chinese name for the Kushans who invaded India. The conventional date for this invasion is

Yuga,युग - an era of the world

APPENDIX B MAPS



(*Include* Amrāvatī *as an N.B.P. ware site*)

Clearly shows the preponderance of sites along the dried up Sarasvati river

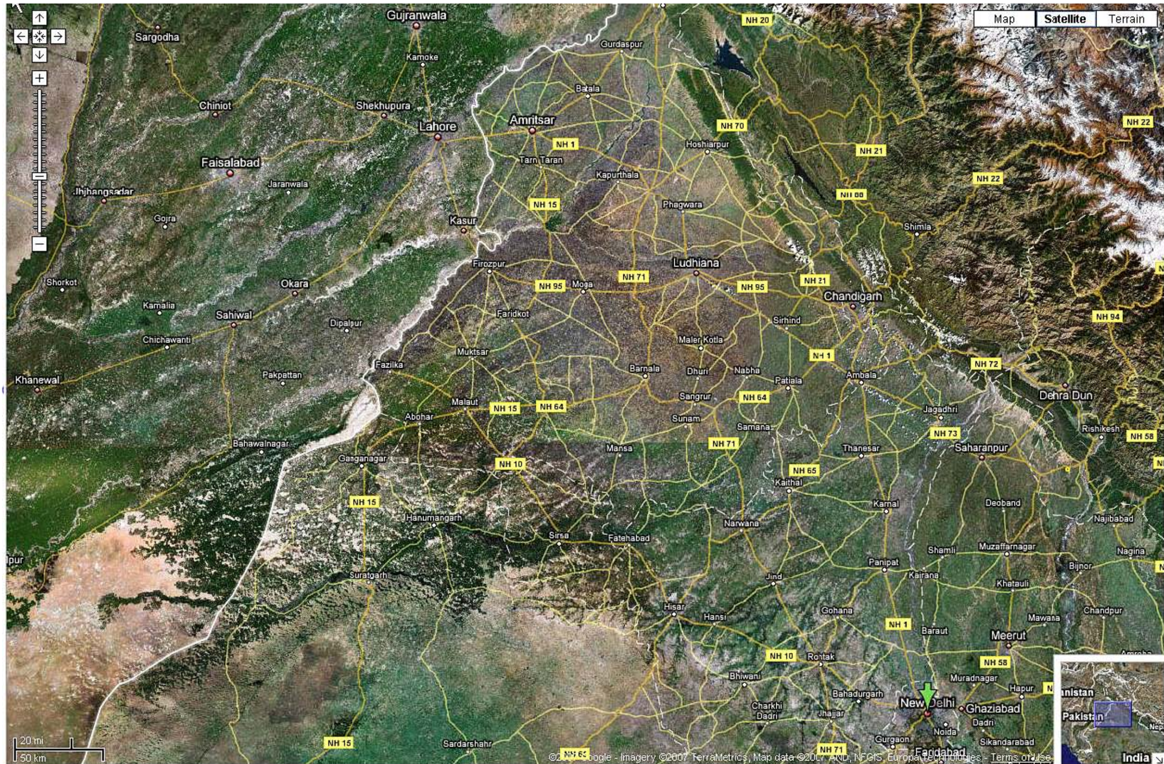


Figure 2 From Google Maps - Region around Delhi, the Sarasvati paleo channel is discernible Figure 3 Map of Magadha (also shows Asmaka, home of Aryabhata)

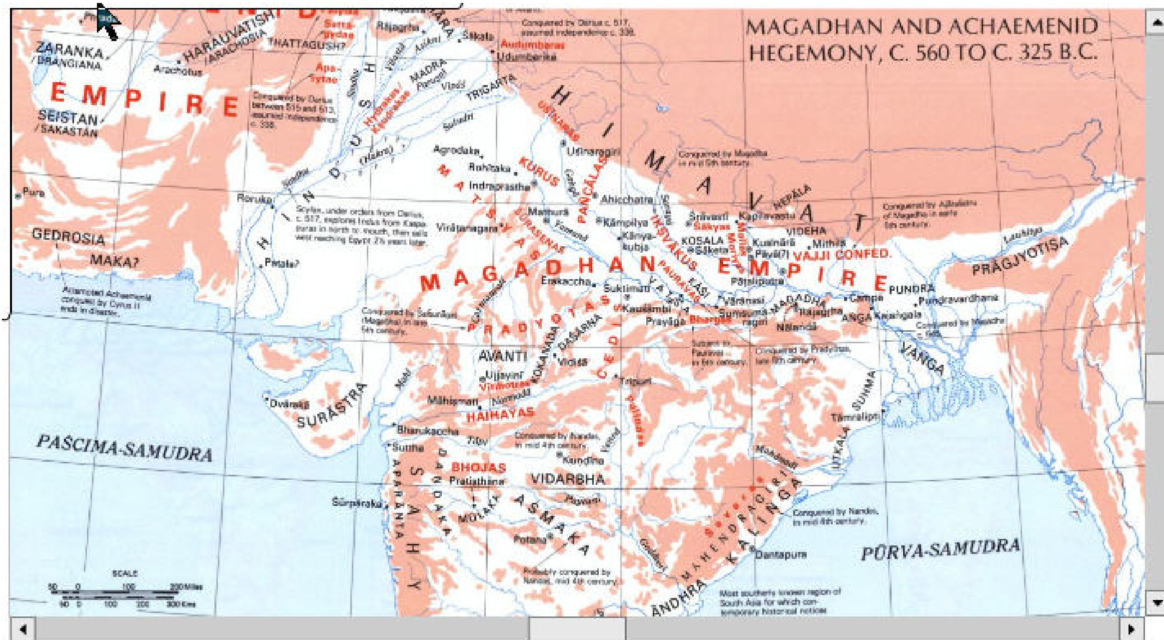




Figure 4 Map of Asia circa 200 CE (conventional timeline) (from Wiki)

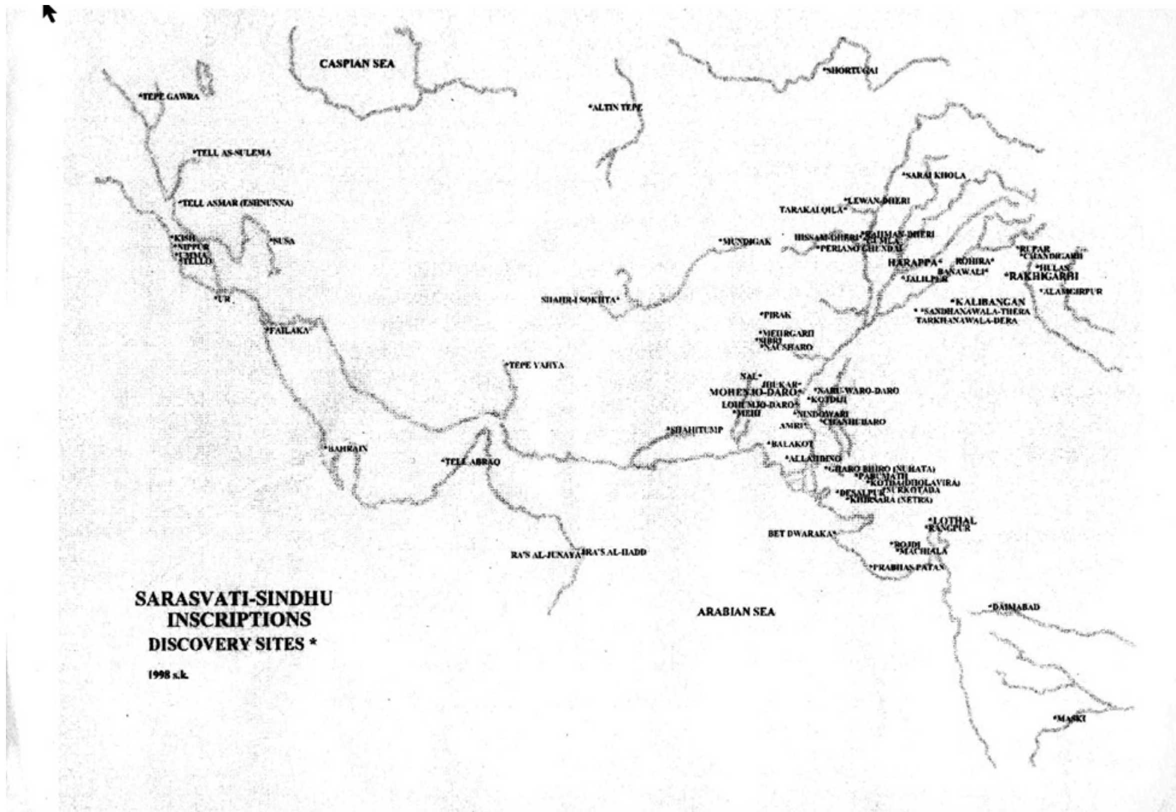


Figure 5 This map shows the newer sites that have been found along the Sarasvati such as Dholavira, Lothal, Rakhigarhi, Kalibangan


Modern India with some places of historical interest
KEY
★ Country capital
■ State capital
● City
GANDHARA
AFGHANISTAN
Kabul
Hadda
Islamabad
CHINA
TIBET
Lhasa
PAKISTAN
UTTARANCHAL
Almora
HARYANA
DELHI
New Delhi
NEPAL
BHUTAN
Harshagiri
Mathura
RAJASTHAN
Jaipur
UTTAR PRADESH
BIHAR
Kausambi
SHAHABAD
Nalanda
Sarnath
Bodhgaya
Kurkihar
Gaya
BANGLADESH
Khajuraho
Bharhut
WEST BENGAL
GUJARAT
Sanchi
Chandraketugarh
Ahmedabad
MADHYA PRADESH
Kolkata (Calcutta)
MYANMAR (BURMA)
Ratnagiri
Tangi
ORISSA
Puri
Konarak
Mumbai (Bombay)
MAHARASHTRA
Hyderabad
Nagarjunakonda
Ratnagiri
Amaravati
Arabian Sea
ANDHRA PRADESH
Bay of Bengal
KARNATAKA
Chennai (Madras)
Shivapuram
TAMIL NADU
Tandantottam
Thanjavur
Nagapattinam
KERALA
Pudukottai
0 100 200 300 400 500 KILOMETRES
0 100 200 MILES
SRI LANKA
Indian Ocean

INDIA
1857

British Dominions
Protected States
Independent States
French
Portuguese

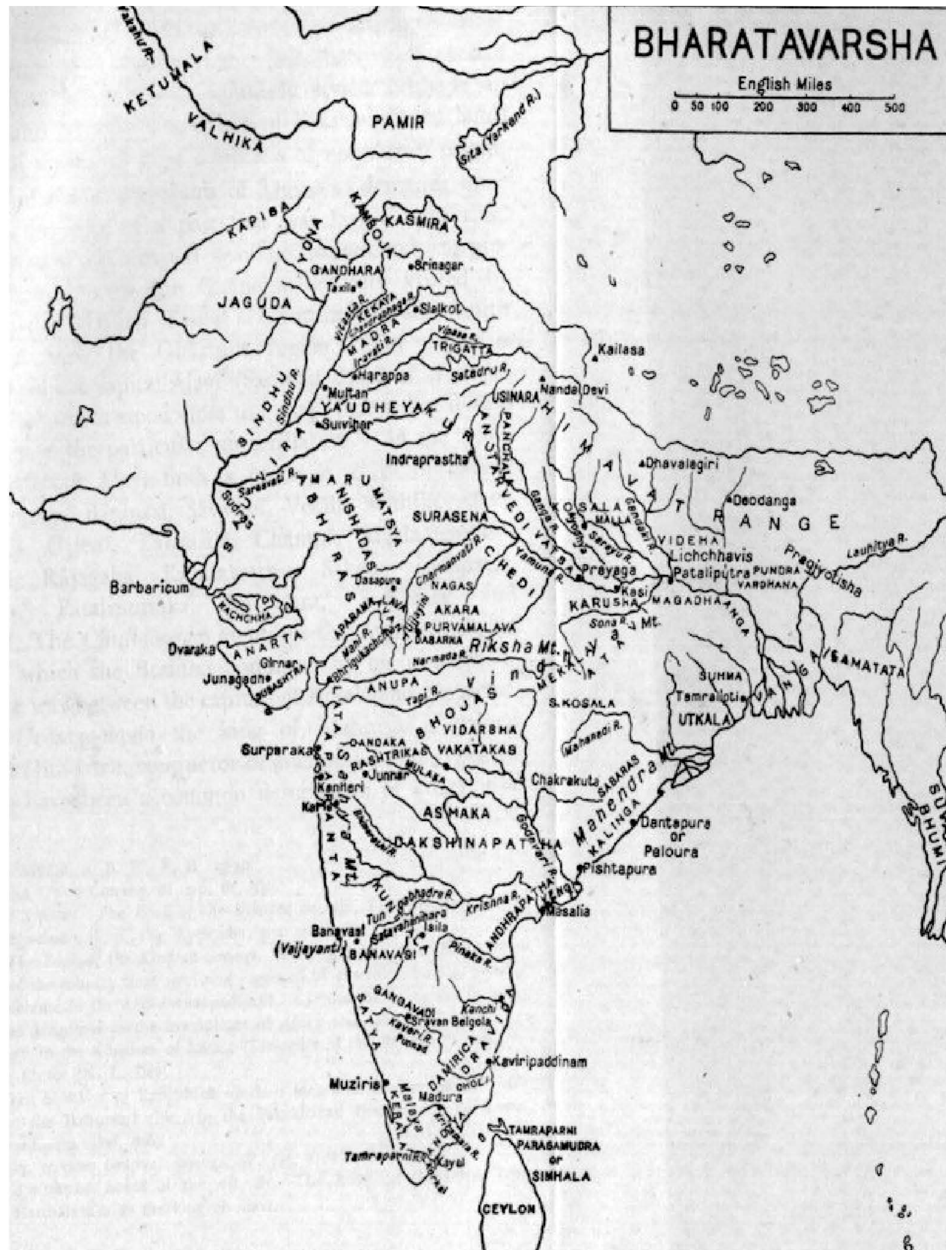

BHARATAVARSHA
English Miles
0 50 100 200 300 400 500
KETUMALA
VALHIKA
PAMIR
KAPISA
KASMIRA
GANDHARA
Srinagar
Taxila
JAGUDA
Sialkot
TRIGATTA
Harappa
Multan
YAUDHEYA
USINARA
Nanda Devi
Kailasa
Indraprastha
Dhavalagiri
SURASENA
KOSALA
Deodanga
VIDEHA
Lichchhavis
Pataliputra
Prayaga
Kasi
KARUSHA
MAGADHA
Barbaricum
Dvaraka
Junagadh
Girnar
ANARTA
AKARA
NAGAS
Riksha Mt.
ANUPA
S. KOSALA
SUHMA
Tamralipti
UTKALA
SAMATATA
VIDARBHA
VAKATAKAS
Surparaka
Junnar
Chakrakuta
ASHAKA
DAKSHINAPATHA
Dantapura
or
Paloura
Pishtapura
Masalia
Banavasi
(Vaijayanti)
BANAVASI
Kanchi
Kaviripaddinam
Muziris
Madura
TAMRAPARNI
PARASAMUDRA
or
SIMHALA
CEYLON
RANGE
HIMAVAT
Mahendra
KALINGA
ANDHRAPATHA
SUVARNABHUMI



Figure 9 A relief map showing the islands of Ionia. We can see Samos and the city of Miletus

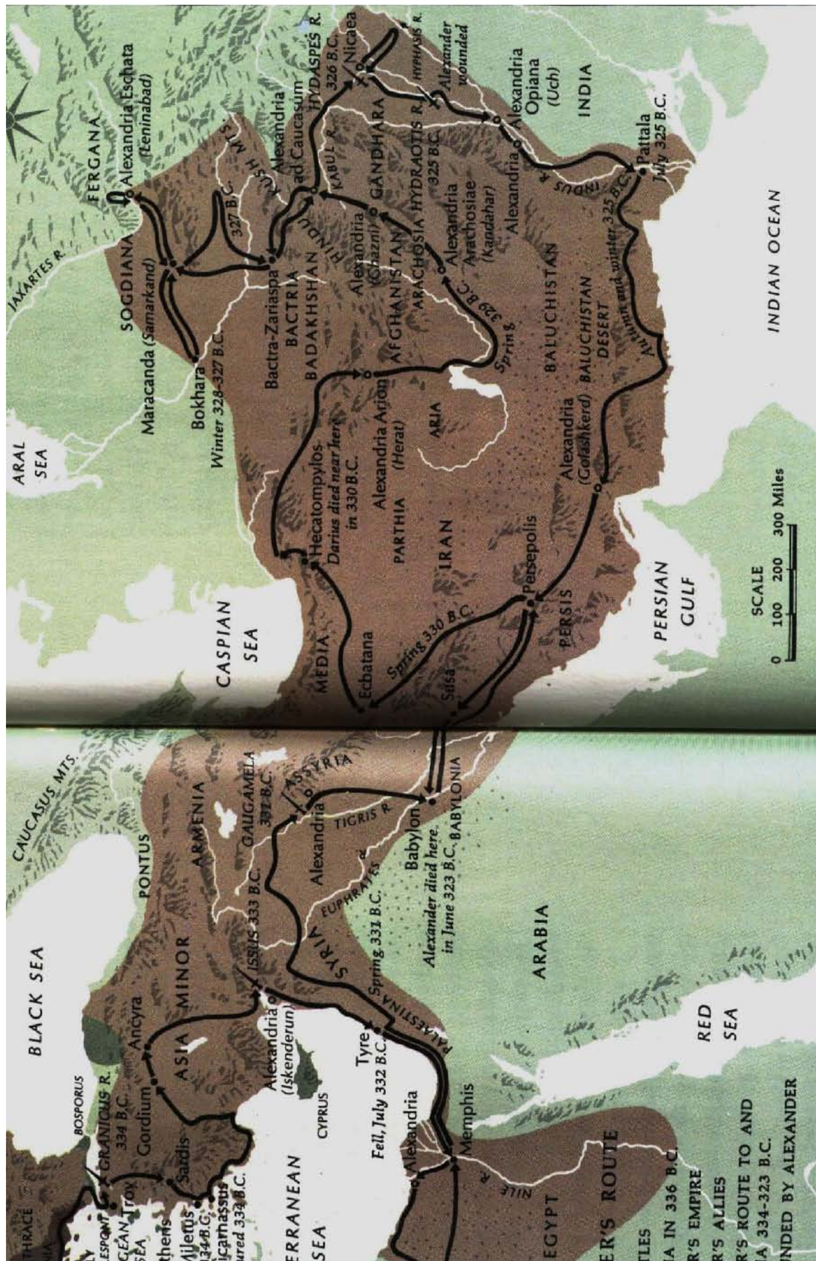
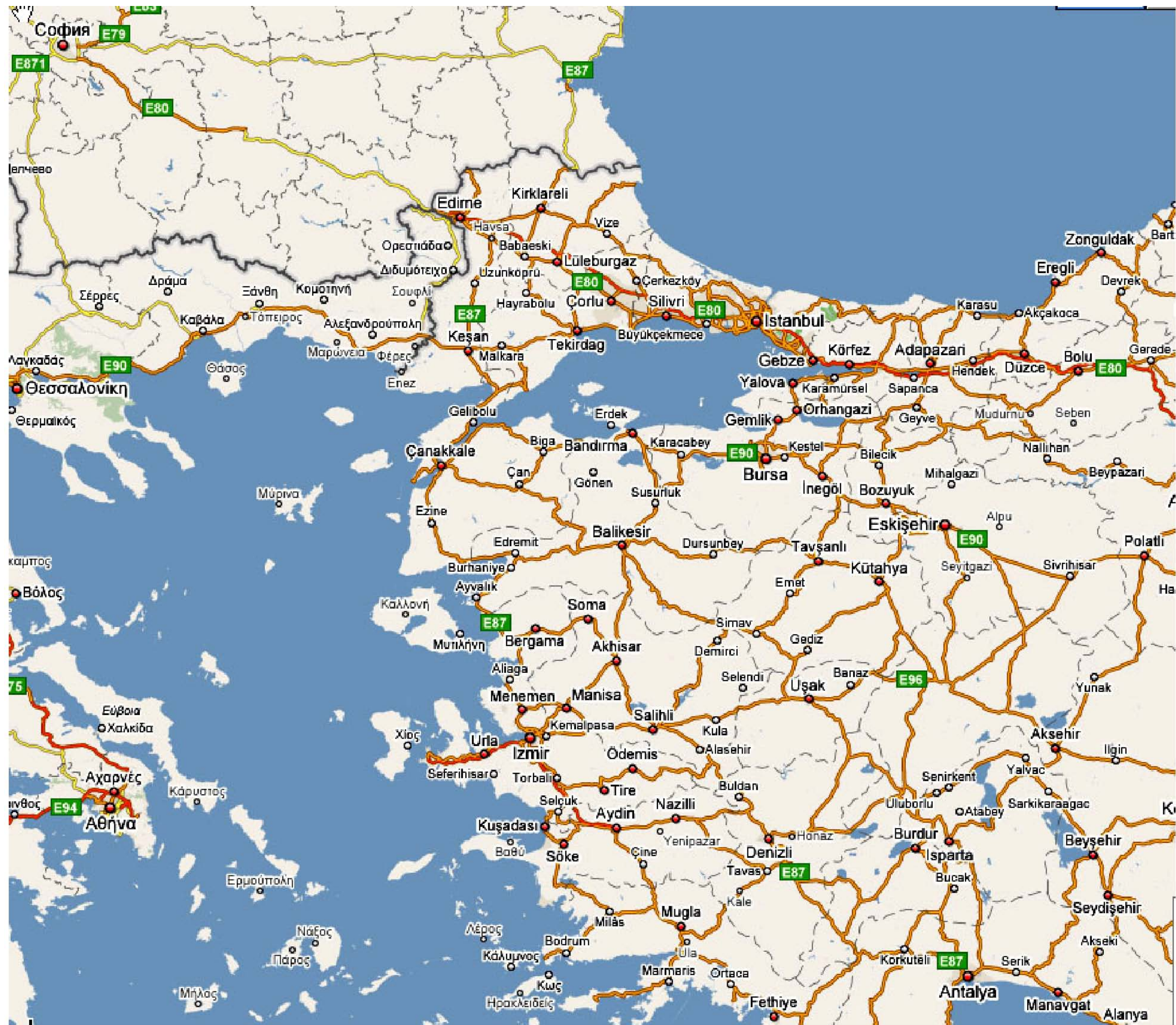


Figure 10 The route of Alexander's invasion Of Asia based on the gleanings of Arrian from primary sources



APPENDIX C PICTORIAL VIGNETTES



Facing page

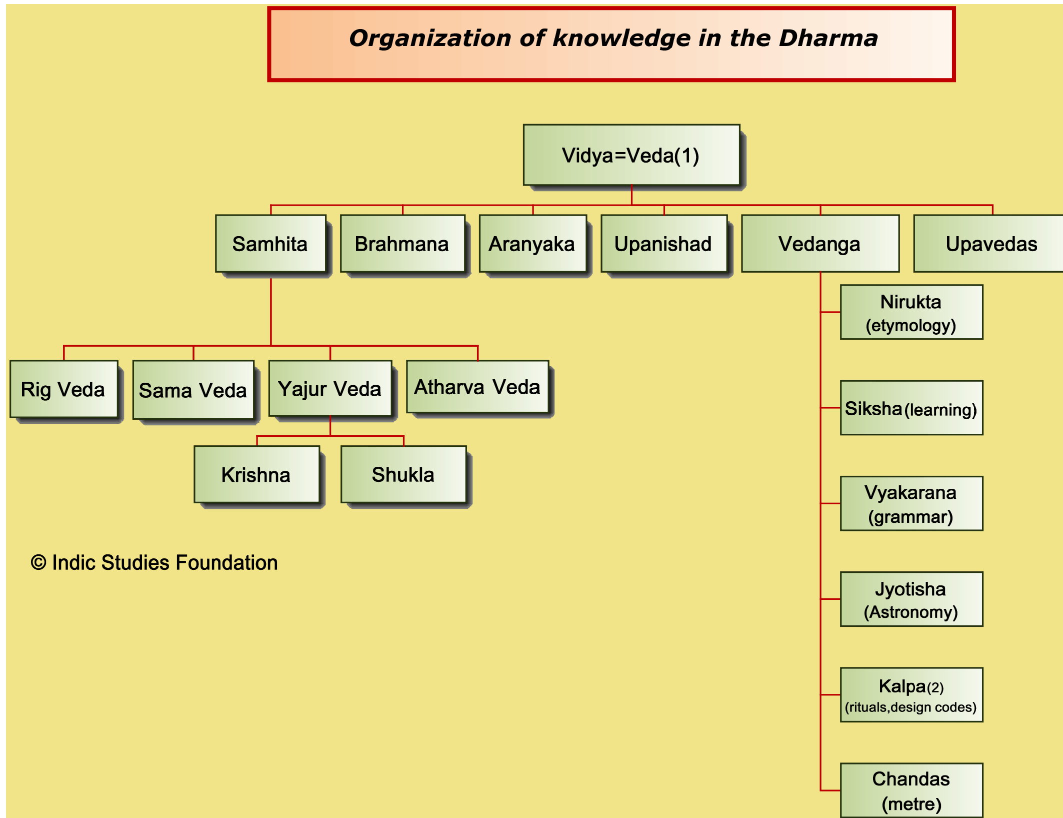
Figure 2 The Bakshali Manuscript

one of the first instances of the use of a decimal place value system, circa 200 ~500 CE

APPENDIX D VEDIC EPISTEMOLOGY

THE VEDIC PARADIGM FOR THE DEVELOPMENT OF KNOWLEDGE

para Vidya (Sciences of the material world) and aPara Vidya (Transcendental Sciences)



In this section we will focus on the theory of knowledge, not so much on the end goal of jivanmuktiviveka but on one of the paths to such a goal, namely the path of Jnana or Knowledge. What is knowledge ? How do we acquire knowledge ? and if and when acquired how do we know whether the knowledge so acquired is the right knowledge and whether it is relevant to the problems faced by the individual ? Before we begin, we recollect why we invoke shaanti 3 times in order to grant us the wisdom and equanimity to overcome 3 possible obstacles

Adhi Daivika represent Cosmic phenomena such as Meteorites, sun spots which cause a disruption in the planet

Adhi Bhautika encompass Terrestrial phenomena such as fire floods, landslides

Adhyatmika, are purely subjective traits such as inertia, lack of faith, insincerity and such , arise from our own negativities

We will briefly touch on the following topics Epistemology of the Dhaarmik tradition (Epistemology is the study of the origin, nature and validity of knowledge).

Darshana दशनर्vision, philosophical doctrine

Pramana -ूमाण Right Knowledge

There are several approaches to accumulating and fine tuning knowledge

Pratyaksha**,** ूत्यक्ष, direct perception, for example ocular proof Anumaana, अनुमान **,** inference

Upamaana, उ�मान Use of analogy,simile

Shabdabodha (शब्दबोध) Cognition caused by an utterance based on Authoritative or scriptural testimony e,g, The Bhagavad Gita. Who determines whether a particular scripture is authoritative. Ultimately it is the individual.

Arthapaati अथ�र्ाि्ठ(Postulate)

Upapatti (उ��ाि्ठ) Necessity of proof or demonstration

Viparyaya, िव�यर्य (Wrong knowledge or lack of discrimination)

Vikalpa विकल्प� (Fancy or Verbal delusion)

Nidra (sleep) िनि

Smriti (Memory) ःॆित

The Shad-Dharshanas

THE Shad-Dharshanas are six great works (Philosophical systems) that shed light on Indian Ethos, the way the Indic looks at the world, which many mistakenly consider to be based on blind belief. Explaining the *Vedas* explicitly, they share with the world the wisdom contained therein. The six texts are based on

- (a) The *Veda*
- (b) Non-belief and
- (c) Inner Vision.

They explain incidents and events that pertain to all the three times of past, present and future. They have taught man how to do away with suffering, restlessness etc., and lead a good life by removing the dirt in him. They explicitly state that the *Vedas, the Vedanta* and the knower *of Vedas* are all one and the same. They explain the nature of the mind which is responsible for all Intelligence, intellect and discrimination. These six great *Dharshanas* (texts) are:

- **(a) *Nyaaya (b)Vaisheshika***
- **(c) *Saankhya***
- **(d) *Yoga***
- ***(e) Puurva-Mimaamsa* and**
- **(f) *Utthara Mimaamsa.***

Valid knowledge and its means

Valid knowledge (prama) is defined as that knowledge which has for its object something that is not already known and is uncontradicted (anadhigata-abaadhita-arthavishayaka-jnaanam). The qualification 'something that is not already known' is meant to exclude recollection. The word 'uncontradicted' excludes illusion or error, as when a rope is mistaken for a snake.

The Mimamsakas hold that time is also cognised through the organs of sense. Thus, when an object is seen, the cognition is connected with the moment when it is seen. As a result, when an object is seen continuously for several moments, the cognition at each moment is considered to be different from the cognition of the same object at the previous or next moment. In this view, the cognition at each moment is a new cognition and so the qualification 'something that is not already known' applies and the definition is applicable. According to Vedanta, however, a continuous cognition for several moments is one single cognition. The knowledge of a pot, for example, is Consciousness reflected in the mental modification (vritti) in the form of the pot and this is just one throughout the time the same pot continues to be seen. In this view also the definition applies.

Objection: According to Advaita Vedanta, all objects such as pot are unreal, being 'mithya', and so the knowledge of the pot is contradicted and it cannot be valid knowledge.

Answer: It is only after the realization of Brahman that the pot is contradicted. In the above definition, 'uncontradicted' means 'not contradicted during the transmigratory state'.

The following is adapted from http://www.dattapeetham.com/

What is Nirvachana (definition)?

For properly understanding a topic, we should be conversant with the correct definitions of the words we useIt was in this context that the question 'what is Nirvachana?' had come up..

Nir-Vachana means, to elucidate appropriately and precisely. It means 'to explain with the help of unambiguous terms what has to be explained'.

In the present context of understanding Vedanta, we were trying to understand the phenomenon of the manifest world and the Knowledge of the Self. Understanding itself is Jnana (knowledge).

Jnana

Jnana is of two types. 1. Yathaartha Jnana and 2. Ayathaartha Jnana.

Yathaartha Janna means understanding an object as that of the literal object only. For example, in the example of rope-snake, to understand a rope to be a rope is Yathaartha Janna.

Wrongly understanding an object (to be something else) is Ayathaartha Janna. This is also called Asatya Jnana (false knowledge). In the analogy of rope and snake, assuming a piece of rope to be a snake is Ayathaartha Janna.

Objection: When simple terms such as Satya Jnana and Asatya Jnana are available, why should difficult words (Yathaartha Jnana and Ayathaartha Jnana) be used? Reply: It is true that they are difficult terms. But they possess more clarity. There are two words Yatha + Artha (in the word Yathaartha). 'To perceive an object as that very object' is the meaning of these words. That is, to perceive a rope as rope is Yathaartha Jnana. Using the word Yathaartha, rather than Satya conveys this meaning better. Because the term is difficult, the men of wisdom have used another simpler word 'Pramaa' in place of Yathaartha. Pramaa means Yathaartha Jnana.

Pramaa (True knowledge, accuracy of perception)

Pramaa is of two types. 1.Smriti (remembrance) and 2. Anubhava (experience).

Smriti is recollection of what has been experienced in the past. Anubhava is perceiving in the present.

Anubhava comes from Pramanas (testimonies) such as Pratyaksha (direct perception). When the knowledge thus obtained with the help of Pramanas remains in the Antahkarana (inner instruments) as Samskara (latent impression) and after some time, due to some reason gets recollected, it becomes 'Smriti). Therefore, it can be said with certainty that for Smriti to occur, the reason can be anything other than testimonies such as Pratyaksha.

Viewed from this angle, there is clear difference between Anubhava Jnana (knowledge obtained from experience) and Smriti Jnana (knowledge obtained by recollection). The former comes from testimonies such as direct perception etc., while the latter comes from something else. Because of this difference, some argue that Smriti Jnana can not be considered as Pramaa and that only Anubhava Jnana should be considered as Pramaa.

From the above discussion, it is clear that 'to perceive an object as that very object' is Pramaa.

Some scholars have explained this in a different way.

Viphala Pravritti (Viphala=failure, futile, fruitless. Pravritti =attempt)

To perceive a snake where there is only a rope is Ayathaartha Jnana. That is, it is Apramaa. (the opposite of Yathaartha is Ayathaartha; the opposite of Pramaa is Apramaa). How could it be known that this is Ayathaartha Jnana (not true knowledge)? The person who had perceived it as a snake took a club and poked at it. After poking several times, he realised 'this is not a snake; this is only a rope'. In other words, his attempt to find a snake there failed! Here, he faced failure. He was subjected to Viphala Pravritti.

To understand this better, let us consider another example. A person is wandering in the seashore on a sunny afternoon. He is alone. In a distance, he saw a shining piece of silver. Immediately he ran to pick it up. By the time he reached that place, he was gasping for breath. To his disappointment, he found that it was not a piece of silver, but only a seashell. This very seashell, when seen from a distance on a sunny afternoon appeared to him as a piece of silver. At that moment, he was under the impression that it was a Yathaartha Jnana (true knowledge). Therefore, he ran towards it. But when he neared that object, he realised that his effort (to find silver) had failed. That is, he was subjected to Viphala Pravritti. Because of this Viphala Pravritti, he now realised that the knowledge that he had in the beginning was in fact Ayathaartha Jnana.

If he had actually found a piece of silver there, his effort would not have become futile. That is, his Pravritti (attempt) would have been Saphala (fruitful). Then he would have got the confirmation that the knowledge he had in the beginning was Yathaartha Jnana.

Therefore, to confirm whether the knowledge is Yathaartha or Ayathaartha, one should try to procure the object about which the person got the knowledge. If the attempt (Pravritti) becomes successful (Saphala), then it is Yathaartha Jnana. If

the attempt becomes futile, it becomes Ayathaartha Jnana.
The above discussion can be condensed as:
'That knowledge which produces Saphala Pravritti is Pramaa; that which produces Viphala Pravritti is Apramaa'.
Thus, two types of definitions have come up for the word Pramaa. 1. To perceive an object to be that very object is Pramaa and, 2. That knowledge which brings about Saphala Pravritti (fruitful attempt) is Pramaa.
Let us now see if Smriti can be considered as Pramaa. In the background of the above two definitions, it must be said that Smriti can be considered as Pramaa. Let us see how. Smriti shows the past experience as it is now. Therefore, according to the first definition, it can not be anything other than Pramaa.
Let us now see if Smriti can satisfy the second definition. Certain knowledge was obtained by recollecting. For example, the recollection "I was short when I was a boy" came now. With the help of reasoning, it was established that I was indeed short then. Thus, the attempt in this regard was Saphala (fruitful). Therefore, Smriti (recollection) too should be considered as Pramaa.
However, some scholars do not accept these verifications or the above definitions of Pramaa.
It might be true that you have established (with the help of reasoning) that you were a dwarf in your boyhood. But can you take upon yourself that form now? Certainly not! Thus, your Pravritti (attempt) here is not Saphala (fruitful). 'Thus Smriti (recollection) is not Pramaa' is their conclusion.
It is not proper to say that one should always make an effort to confirm the knowledge one gets before accepting it to be true and that only after such confirmation one should accept it as true. For example, dense smoke is visible on a hill. Common sense says that there is forest fire on the hill. Because this knowledge is true, the farmers are taking precautions to prevent their cattle from going in that direction. If it is said that this knowledge is not true, it would mean that every farmer should climb the hill, see the fire there, and then realise that the knowledge that they had got in the beginning was correct. This is impracticable. Therefore, the scholars have given another definition for the word Pramaa: 'The knowledge that is obtained with the help of Pramanas (testimonies) such as Pratyaksha etc., is Pramaa'.
What are Pramanas? How many are they? What is Pratyaksha? What is Pramana? It appears as though this discussion is drawing us very far. In whatever way we define it, the summary is 'Pramaa is that knowledge which produces Yathaartha and that which produces Pramaa is Pramana'.
It means that to know the definition of the word 'Pramana', one should first know the definition of the word 'Pramaa'. In this lesson, two definitions for Pramaa were proposed and subsequently both the definitions were discarded in favour of a third definition. But according to the third definition, Pramana and Pramaa are interdependent. That is, to understand one, the other has to be understood first. It is like saying 'one can not marry unless one is cured of madness and madness can be cured only if one marries'. This is called as Anyonyaashraya Dosha (fault of mutual dependence)
In order to come out of this catch-22 situation, Vedanta proposes a different definition for the word Pramaa.

Definition of Pramaa

The Vedantic science postulates that Pramaa is "that knowledge which has as its subject, an object which has no Baadhaa (contradiction)".
The word Baadhaa generally means distress. However, here the meaning is different.If an object is destroyed along with its Upaadaana Kaarana, then such destruction is called Baadhaa.
Every Karya (result) has many Kaaranas (causes) in the background. For example, if a pot has to result, it requires various causes such as the potter, clay, wheel, the stick that is used to turn the wheel etc.. Even if one of these is not present, the pot can not result. Therefore, for the resultant pot, all these are causes. Among these, it is only the clay that enters the result and stays with it (with the Karya). That cause which enters in to the result is called Upaadaana Kaarana.
Assume that the pot breaks. What is destroyed then is the pot, not the clay. In other words, the result is destroyed, but its Upaadaana Kaarana (material cause) still remains. This phenomenon of the pot ceasing to exist is called Naasha (destruction). Baadhaa is quite different from Naasha.
A person mistakes a rope to be a snake. What happened here? The person knows that some long object is there. However, he does not clearly know what it is. Ignorance (of not knowing the real nature of that object) itself resulted in the form of snake. (We had discussed about this in the 15th and 18th lessons). Therefore, here, snake to result, the ignorance acted as the Upaadaana Kaarana.
When a torch was held near this object, the snake as well as its cause, namely ignorance about the object vanished simultaneously. What truly existed was perceived. Observe here that both the result and its cause vanished simultaneously. This process of vanishing of the Upaadaana Kaarana along with the effect (Karya) is called 'Baadhaa'.
The knowledge of that object which does not have such Baadhaa is termed Pramaa.

To know if the knowledge obtained by us is Pramaa knowledge or not, we must first see if the object we perceive has Baadhaa (hindrance, contradiction) or not. We saw a pot. The pot may undergo destruction. It can not be subjected to Baadhaa. That is, it can not be annulled. Therefore, its knowledge is Pramaa knowledge. We 'saw' silver in the sea shell. Subsequently, when the knowledge that it is only a seashell dawns, the silver undergoes 'Baadhaa'. In other words, as soon as the reality is known, the silver as well as its cause, namely ignorance, will cease to exist. Therefore, such knowledge is not Pramaa. It is Apramaa.

A person remembered the pot that he had seen the day before. Here, the remembrance may have destruction, but it does not undergo Baadhaa. Therefore, according to the above definition, even Smriti (remembrance) is also Pramaa knowledge.

Even while inferring that there is fire on the mountain (by the sight of the smoke), the fire there does not become subjected to Baadhaa. Therefore, that knowledge is also Pramaa knowledge.

Some scholars thought it prudent not to include Smriti (remembrance) in Pramaa and thought that it should be considered as separate. They modified the definition of
Pramaa slightly as follows:

"That which is not hitherto known and that knowledge which is not subjected to Baadhaa, is called Pramaa".

Although the object that is perceived by remembering does not become subjected to Baadhaa, because the knowledge of that object was there already, it does not become Pramaa knowledge according to the above definition.

Objection: There seems to be some hitch in this definition. A person is continuously and looking at a pot. What happens here? As soon as he sees it, he will get the knowledge –'this is a pot'. Any knowledge remains only for a moment, is it not? Thus, in the second moment, he will get a fresh knowledge – 'this is a pot'. Similarly, he will get the same knowledge again, for the third time and so on. The knowledge - 'this is a pot' which comes in quick successions is called as Dhaaraavaahika Buddhi. (dhaaraa=stream). In this situation, the same knowledge that was acquired in the first instance is acquired in the subsequent instances too. Therefore, the knowledge gained in the second, third, forth etc., instances is something which was already known and therefore, according to your new definition, the knowledge of the pot is not Pramaa knowledge. Do you agree?

Reply: Hold a minute! Your question is based on the assumption that knowledge has momentary existence. Any object or phenomena takes birth only if there is a cause behind it. Also, it will undergo destruction only if there is a cause for destruction. There is no reason or cause for the knowledge (of the pot) to vanish. The knowledge of the pot comes in to being because the Chaitanya reflects in the Vritti (modification) of the Antahkarana (inner instrument). As long as there is no obstruction to that Vritti and till such time that another Vritti takes birth in the Antahkarana, the first Vritti remains unaffected and unaltered. Therefore, there is no such thing as stream of knowledge here.

Objection: In the opinion of Vedanta, is not the entire creation false? Therefore, the parts of the creation (in this context the pot), are also do not have real existence. That is, everything must undergo Baadhaa at one point of time or the other. Thus, the knowledge that the person got when he saw the pot is not Yathaartha Jnaana (true knowledge). In other words, in this world no person can have any knowledge of any object at any point of time. Do you agree?

Reply: All our discussions are taking place in the mundane level. The manifest creation will be subjected to Baadhaa (i.e., the knowledge that the world is unreal will dawn) only after Brahma Saakshaatkaara (realization of Brahman) takes place. Before this, i.e., while we are still in the mundane level, the expression 'that which does not undergo Baadhaa' actually means 'that which, in the mundane level, does not undergo Baadhaa'. It does not apply to the Baadhaa that takes place after the Brahma Jnana is acquired.

By the above discussions, we understood two things very clearly.

1. That knowledge which has as its subject an object that is not subjected to Baadhaa is Pramaa knowledge.
2. That which is not hitherto known, and that knowledge which has as its subject an object which is not subjected to Baadhaa is Pramaa knowledge.

The difference between the two definitions is that, in the first definition Smriti (remembrance) too is considered as Pramaa, whereas in the second definition, Smriti is not considered as Pramaa.

That which is the instrument for such a Pramaa is called Pramaana.

Pramaana

What is Karana? To understand this properly, we should understand the meanings of the words such as Kaarana, Kaaraka

and Vyaapaara.
Kaarana: That which is the direct cause of an action, and in the absence of which, that action does not take place, is called as Kaarana. For example, in the production of pot, there will be in its immediate past, several factors such as clay, wheel, the shaft that turns the wheel, the potter, Kaala (time), Adrishta (the unseen) etc. Even if one of the above is not there, the pot cannot result. Therefore, all these are considered as Kaaranas. Kaaranas are if four types.

1 Saadhaarana Kaarana (common cause)
2 Asaadhaarana Kaarana (special cause)
3 Upaadana Kaarana (explained earlier)
4 Nimitta Kaarana (explained earlier)

In the above set of causes (for the pot), aspects such as Kaala and Adrishta have also been considered as Kaaranas. They are Kaaranas not only for the pot, but also for anything and everything in the manifest universe. Thus, they are called as Saadhaarana Kaarana. (common causes).
All causes other than these two (clay to potter) are causes only for the pot. They cannot be causes for say, a knife or an arrow. Therefore, they are considered as special causes for the pot. Thus, those causes that are specific in producing a result are called as Asaadhaarana Kaaranas.
Among the special causes, it is only the clay that remains even after the effect (that is, the pot) is produced. Such causes are called as Upaadaana Kaaranas. Thus, such a cause, which is present before, during and after the result is produced, is called as
Upaadaana Kaarana. All Asaadhaarana Kaaranas that are not Upaadaana in nature are referred to as Nimitta Kaaranas.
Kaaraka: Just as the factors behind the effect are called as Kaarana, the factor behind the action is called as Kaaraka. What does 'being behind the action' mean? It refers to that aspect which actually carries out the action. That is, that which is immediately behind the action.
For example, we say 'this axe is cutting the crop'. Here, an action, namely cutting of the crop is taking place. Who is doing that? The axe is doing. Is axe alone doing it? No. There is a hand behind it and there is a man behind that hand. All though all the three take part in the action called cutting, it is the axe that is actually doing the cutting. Such a factor is called as 'Kriyaanirvartaka'.
Vyaapaara: Vyaapaara means transaction. For a result to manifest, many transactions have to take place. For example, for the pot to manifest, several transactions have to take place. The wheel has to turn. Here, the turning of the wheel should also be included in the list of Kaaranas. But, this is present hidden in the Asaadhaarana Kaarana group. It does not have independent existence. That transaction which is dependent on one of the Asaadhaarana Kaaranas and behaves as a cause is called as Vyaapaara.
In the above illustration, the wheel is one of the specific causes for the pot. The transaction called turning is dependent on it. In other words, the turning takes place only in the pot. This transaction of turning also takes part in the production of the pot. Here the transaction called turning is referred to as 'Vyaapaara'.
That transaction which takes birth along from an Asaadhaarana Kaarana, and takes part along with it in the production of the end result (thus acting as a cause itself) is called as Vyaapaara.
Karana: For any Kaarya (effect) to manifest, it is not enough if all the causes are present. In order to produce the result, at least some of them should work or transact. That which carries out the transaction is called the Karana. In the above illustration, the wheel is the Karana.
If this concept can be presented in the form of a definition as follows: In the production of a Kaarya (effect), the cause that transacts is called Karana. All this discussion came up while defining the term Pramaa. It was said that that which is the Karana for Pramaa is Pramaana. That is, among the various specific causes present in producing correct perception, that which has transaction is called Pramaana.
For example, assume that we see a beautiful tree and develop liking for it. Here, both the eyes and the light are the causes for the liking. The light does not do anything. The eye, on the other hand, does the transaction called seeing. Therefore, for the liking the eyes serve as the Karanas. Therefore, the eyes are considered as Pramaana.
How many Pramaanas are there? Different scholars have given different opinions. Let us discuss about them later.
Pramanas – their number
Different scholars have given different opinions about the number of the essential pramanas. Charvakas, (the atheists) have declared that there is only one Pramaana and that is Pratyaksha.
Bouddhists and the scholars belonging to Kanaada school of thought include Anumaana also and say that Pramanas are

two in number. Anumaana is inference. It is not proper to think that everything in this world can be understood by Pratyaksha (direct perception) alone. Inference done with due caution also worthy of believing. Therefore Anumaana is also a Pramaana – opine these scholars.
The proponents of Saankhya school of thought say that along with Pratyaksha and Anumaana, Shabda is also a Pramaana. Shade means words of an intimate and trustworthy person. It is not enough to limit ourselves to direct perception or inference. We should believe the words of men of wisdom – this is the idea of the Saankhyas. The Vedas are the most superior in this category. Therefore, the Vedas are referred to as. They are also called as Agama.
The scholars belonging to Tarka (logic) school of thought say that along with Pratyaksha, Anumaana and, even Upamaana (simile) should also be considered as a Pramaana. Upamaana is similarity. For example, we showed a flying animal to a person and told him that it was a crow. After sometime, a similar looking animal came there, this person can easily say that it is also a crow. From where did he get this knowledge? He got this knowledge by comparing this object with the one he had seen earlier. Because Upamaana helps in knowing an object, it should also be considered as a Pramaana – is the opinion of the logicians.
The scholars of Meemaamsa Shastra (particularly the Praabhaakara school) include Arthaapatti along with the above four. Arthapatti is postulation. It is described as the necessary supposition of an unperceived fact that demands an explanation. For example, if a person is fasting during the day and yet is growing fat, we are forced to conclude that he is eating at night. Such postulation is Arthapatti. In simple language, Arthapatti means that which easily becomes evident.
This is not mere imagination. Here there is a clear understanding that in the absence of a particular act, what has become evident could not have happened at all. We see many such examples in life. Therefore Arthapatti should also be considered as a Pramaana is the opinion of the Meemaamsa scholars.
Another school pertaining to Meemaamsa Shastra, the Bhaatta school opines that along with the above five (Pratyaksha, Anumaana, Upamaana and Arthapatti), another Pramaana, namely Anupalabdhi should also be included. The knowledge that a particular object is not present (here) is Anupalabdhi. If there is a tree before us, we will perceive it. For this, the eyes serve as Pramaana. If there is nothing before us, the eyes do not say 'there is no tree here', 'there is no jar here', 'there is no rock here' and so on.
Therefore, there is a Pramaana that tells us about the non-existence of objects. It is called Anupalabdhi. When we do not perceive a pot on a table before us, we come to know that it does not exist. Thus, it is a negative means of knowledge.
The Pouranikas (mythologists) suggest that two more Pramanas, namely, Sambhava and Aitihya should also be considered along with the above six Pramanas.
Sambhava means educated guess. For example, when we take a vessel to an experienced cook, he can say with certainty that a particular amout of rice can be cooked in that vessel. That which brings about such knowledge is called as
Sambhava Pramaana.
Aitihya means traditional instruction that has been handed down though generations.
Mythologists say that even this should be considered as a Pramaana.
The Vedantists have thoroughly examined all the above Pramanas and have declared that
Pramanas are six in number. According to Vedanta, Pratyaksha, Anumaana, Upamaana, Agama,
Arthapatti and Anupalabdhi are the six accepted Pramanas. Therefore Vedantists are also
referred to as Shat-Pramaana-Vaadins. (Shat=six, Pramaana=evidence, Vaadi=proponent)
Let us try to understand the six Pramaanas with the help of definitions.

Nyaaya Dharshana* forms the life for other *dharshanas

it is also called *Gautama Shaasthra.* This forms the life for the remaining five *Dharshanas.* We have measures to judge the quantity and volume of material in the world. Even in respect of Divinity, a measure must be available by which the proof may be obtained. *Vedas* speak of four kinds of proofs. They are

- (1) *Pratyaksha* (direct perception),
- (2) *Anumaana* (inference),
- (3) *Upamaana* (comparison)and
- (4) *Shabdha* (sound).

Prathyaksha pramaana: This is called direct proof, as it is perceived by the sense organs. These organs are only instruments. The mind enters them and helps them to function. There are some limitations on the senses like disease and imperfection, that make proof obtained by this method to be infirm. For example, a normal eye can see all colors, a

jaundiced eye sees everything as yellow. Though the *laddu* is sweet, the tongue of a malaria patient classifies it as bitter. Here, there are two points of view. From the point of view of the matter it is sweet. But from the point of view of the senses it is bitter. It can be concluded, therefore, direct proof is not complete evidence for real justice.

Inference

Anumaana pramaana: This is based on doubt and inference. One sees cranes in the distance, for example, and infers that water Could be available there. Similarly, one infers about fire by seeing the smoke, from the *Svabhaava* (natural traits), one. makes out about the *Svaruupa* (the real form).

Inference or **anumaana** is defined as that cognition which presupposes some other cognition. It is knowledge which arises (anu) after another knowledge. It is mediate and indirect and arises through a mark, linga or hetu (middle term) which is invariably connected with the saadhya (the major term). Invariable concomitance (vyaapti) is the nerve of inference. The presence of the linga in the paksha (minor term) is called pakshadharmataa. The invariable association of the linga with the saadhya is called vyaapti.

According to Nyaya, anumaana (inference) is the efficient instrument (karana) of inferential knowledge (anumiti). Anumiti is knowledge that arises from paraamarsa. Paraamarsa is a complex cognition which arises from a combination of the knowledge of invariable concomitance (vyaaptijnaana) and that of the presence of the linga in the paksha -- technically known as pakshadharmataajnaana.

Upamaana pramaana: This kind of testimony is based on comparison. It enables us to understand many things that cannot be otherwise easily understood, by comparing them to some others that can be. By studying the *Praathibhasika* (apparent reality) and the *Vyaavahaarika* (empirical reality), one can infer about *the Paaramaarthika* (transcendental). For example, by studying the foam (empirical reality) that originates from the waves (apparent reality), one can understand the reality of the Ocean (transcendental reality). This is possible because both the foam and the waves originate from the Ocean, and mirror its character in them. This is the example cited for all beings emanating from the Ocean of Divinity as waves.

***Shabdha pramaana* is the ultimate proof**

Shabdha pramaana: It is the proof garnered on the basis of sound. It is considered to be the ultimate proof. It is based on the testimony of the sound that the *Vedas, Vedaangas, Upanishaths* and the Bhagavath Geetha came into existence, But, to be able to perceive this testimony, one must be properly attuned and extremely careful. It needs one to travel beyond the mind and the senses. At this stage of *Samaana chittha* (mental equanimity), sound becomes the very form of God. The eight forms of God are *Shabdha Brahma mayee* (sound), *Charaachara mayee* (All pervasiveness), *Paraathpara mayee* (Transcendental nature), *Vaang mayee* (speech), *Nithyaanandha mayee* (blissful), *Jyothir mayee* (Effulgence), *Maaya mayee* (illusion) and *Shreemayee* (prosperity).

(5311 words)

APPENDIX E INDEX OF INDIC SAVANTS IN THE COMPUTATIONAL SCIENCES FROM ANTIQUITY

1.	A. Krishnaswami Ayyangar ·
2.	Acyuta Pisarati (c. 1550 CE-1621 CE)
3.	Apastambha, author of Sulva Sutra, circa 2000 BCE
4.	Aryabhata (476 CE - 550 CE.)
5.	Aryabhata Ia (author of Aryabhata Siddhanta)
6.	Aryabhata lb (author of Aryabhattiyum of Kusumapura) Born in Asmaka,, A1b = or not=A1a
7.	Aryabhata II (9
8.	Bakshali Manuscript
9.	Baudhayana (fl. 700 B.C.E.)
10.	Bhaskara I ·
11.	Bhadrabahu
12.	Bhartrihari, considered to be the father of semantics
13.	Bhaskara (1114-c. 1185)
14.	Bhaskara 1(629 CE of Vallabhi country)
15.	Bhaskara II (Bhaskaracharya son of Maheshwara)
16.	Bhattotpala of Kashmir (966 CE)
17.	Bhutivesnu son of Devaraja, circa 14th century CE?
18.	Bose
19.	Brahmadeva ·
20.	Brahmadeva son of Chandrabuddha 1092 ce
21.	Brahmagupta (c. 598-c. 670) , son of Jisnugupta
22.	Brihaddeshi ·
23.	Calyampudi Radhakrishna Rao ·
24.	Cangadeva (fl. 1205)
25.	Chandraprajnapati, ? 5"' century BCE
26.	Chandrasekhara Simha or Chandrasekhar Samanta (are they the same — yes)) 1835 CE
27.	D. K. Ray-Chaudhuri ·
28.	Damodara, son of Parameswara and guru of Nilakantha Somasutvan also
29.	Dasaballa (son of Vairochana) 1055 CE
30.	Deva (Deva Acharya)
31.	Gaargeya
32.	Ganesha Daivajna I (1505 CE son of Lakshmi and Kesava))
33.	Ganesha Daivajnya II (great grandson of Ganesha Daivajnya 1(1600 CE)
34.	Gangadhara
35.	Gangesha Upadhyaya ·
36.	Ghatigopa
37.	Govinda Bhatta
38.	Govindaswami (c. 800-850)
39.	Halayudha (fl. 975)
40.	Haridatta (circa 850 CE)
41.	Harish-Chandra ·
42.	Hemachandra Suri (b. 1089)
43.	Hemcha n dra
44.	Jaganath Pandit (fl. 1700)
45.	Jagannatha Samrat ·
46.	Jayadeva (fl. 1000)

47.	Jayant Narlikar ·
48.	Jyesthadeva of KERALA (circa 1500 CE?)
49.	Kamalakara (1616) alt.1610 CE, son of narasimha (belongs to Daivjnya
50.	Katyayana , Author of Sulva Sutras
51.	Kesava Daivajna
52.	Kodandarama (1807-1893) of the Telugu country alternate (1854CE) son
53.	Krishna Daivajna
54.	Krisnadesa
55.	Kumararajiva
56.	Lagadha
57.	Lakshmidasa , son of Vachaspati Misra
58.	Lakshmidasa Daivajna
59.	Lalla son of Bhatta Trivikrama
60.	Latadeva , pupil of Aryabhata lb
61.	Lokavibhaga (Jaina text)
62.	Madhava (son of Virupaksha of the Telugu country)
63.	Madhava of Sangramagama in Kerala (1340 to 1425 CE
64.	Mahadeva (son of Bandhuka)
65.	Mahadeva son of parasurama,
66.	Maharajah Sawai Jai Singh
67.	Mahavira (Mahaviracharya) (fl. 850)
68.	Mahavira , founder of Jainism, author of Surya prajnapati and
69.	Mahavira of the Digambara sect
70.	Mahendra Sun (1349 CE)
71.	Mahendra Sun, pupil of Madana Sun , (1370 CE)
72.	Malayagiri, Jam Monk from Gujarat
73.	Malikarjuna Sun , 1178 CE, name suggest Telugu country
74.	Manava
75.	Manjula
76.	Manjula (fl. 930)
77.	Mathukumalli V. Subbarao ·
78.	Melpathur Narayana Bhattathiri ·
79.	Munishvara ·
80.	Nagesh Daivajnya (son of Shiva Daivajnya) (1619 CE)
81.	Narasimha Daivajna (son of Krishna Daivajnya) 1586 CE
82.	Narayana Pandit (fl. 1350)
83.	Narayana (c. 1500-1575)
84.	Narendra Karmarkar ·
85.	Navin M. Singhi ·
86.	Nilakantha Somayaji or Nilakantha Somasutvan (1444 CE to 1550 CE) of
87.	Nisanku - son of Venkataknishna Sastri (source, sourcebook KVS)
88.	Padmanabha son of Narmada (same as Parameswara?)
89.	Panduranga swami
90.	Panini ·
91.	Paramesvara (1360-1455 CE) alt.1380 — 1460 CE,a Namputiri of Vataserri in Kerala
92.	Patodi
93.	Pillai
94.	Pingala
95.	Prabhakara (pupil of Aryabhata I, 525 CE?
96.	Prasanta Chandra Mahalanobis ·
97.	Prashastidhara (fl. 958)
98.	Pruthudakaswami (fl. 850)

99.	Putumana Somayaji (c. 1660-1740)
100.	Raghunath Raj
101.	Raj Chandra Bose ·
102.	Rajagopal
103.	Rama Daivajnya , sonn of Madhusudhana Daivajnya
104.	Ramanujam
105.	Ranganatha son of Narasimha Daivajnya (1643 CE) . commentary on Surya Siddhanta
106.	referred to as son of Padmanabha (1417 CE) are they one and the same
107.	S. N. Roy ·
108.	S. S. Shrikhande ·
109.	Saamanta Chandrasekhar Simha (see also Chandrasekhar Sinha)
110.	Sankara Variyar (1500 — 1600 CE) pupil of Jyeshtadeva
111.	Sankara Varman (fl. 1800)
112.	Sarvadaman Chowla ·
113.	Satyendra Nath Bose ·
114.	Shreeram Shankar Abhyankar ·
115.	Somaswara circa 11 century CE
116.	Sridhara (fl. 900)
117.	Sridharacharya
118.	Srinivasa Ramanujan ·
119.	Sripati (son of Nagadeva, 999 CE)
120.	Subrahmanyan Chandrasekhar ·
121.	Suryadeva Yajwan (1191 CE of Gangaikonda Cholapuram in Tamilnadu)
122.	The Daivajna Family — The Bernoullis of India
123.	Trikkantiyur -
124.	Umaswati (fl. 150 B.C.E.)
125.	Varahamihira (c. 505-c. 558)
126.	Varahamihira (son of Adityadasa)
127.	Venkatesh Ketkar
128.	Vijayanandi
129.	Vijay Kumar Patodi ·
130.	Virasena ·
131.	Virasena Acharya
132.	Virupaksha Suri of the Telugu country
133.	Vishnu Daivajnya (son of Divakara Daivajnya) same as Visvanatha?
134.	Visvanatha Daivajna (son of Divakara Daivajna) 1578 CE
135.	Yajnavalkya
136.	Yallaiya (1482 CE of Skandasomeswara of the Telugu country)
137.	Yaska
138.	Yatavrisham Acharya
139.	Yativrsabha
140.	Yavanesvara

(534 words)



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ABBREVIATIONS

ASWI	Archaeological Survey of Western India ; particularly, vol. IV (1876-9) where the caves used in the present work are de scribed, though not too well, even with the supplementary aid of Burgess's Buddhist Cave Temples.
A	Aryabhatiya of Aryabhata 1b
AA	Aitreya Aranyaka
AB	Aitareya Brahmana; translation by A. B. Keith, in HOS 25.
ASIA	Annual Bibliography of Indian Archaeology (Leiden).
ABORI .	Annals of the Bhandarkar Oriental Research Institute (Poona)
AI	Ancient India (Archaeological Dept. Publication, nos. 1-11).
AK	The Arthasastra of Kautilya (otherwise known as Chanakya, Vishnugupta, and Kautilya). Ed. T.
Alb	AlBiruni's India trans. Ed. Sachau, 2 vol. London 1910 ; 2 vol. in one. London 1914. AlBiruni was a
AM	Amarakosha
ASA	Aryabhata Siddhanta of Aryabhata Ia
AV	The Atharva-veda, mostly from W. D. Whitney's translation, HOS. 7-8 ; also the selections translated by
BS	Brahmasputa Siddhanta
BHP	Brihat Parasara Horasastra
BD	Baudhayana Dharmasutra
BASOR	Bulletin of the American Schools of Oriental Research.
ChUp.	Chandogya Upanishad
CSIR	Council of Scientific and Industrial Research
ICHR	Indian Council of Historical Research
IJHS	Indian Journal of History of Science
INSA	Indian National Science Academy
JESHO	Journal of the social and economic History of the Orient; published at Leiden under the editorship of an international board
LB	Lilavati of Bhaskara II
MB1	Mahabhãskaryam of Bhäskara I
P5S	Panchasiddhantika
PHSPC	Project of History of Science, Philoosphy, andCulture in Indian Civilizations
PS	Paulisa Siddhanta
RB	Rajamriganka by Bhoja
RS	Romaka Siddhanta
SB	Satapatha Brahmana
SidS	Siddhanta Shiromani

SS	SuryaSiddhanta

- AIAM Ancient Indian Astronomy and Mathematics

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Yajur Veda, XXX,10
Chaandogya Upanishad, 1.2.4;2.1;7.1

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APPENDIX E BIBLIOGRAPHY KOSAMBI'S CATALOGUE OF PRIMARY SOURCE MATERIAL

AIA Art in the Ice Age, Spanish Levant Art, Arctic Art by J. Mariger and H. G. Bandi, in execution of a plan by Htigo Obermaier (tr. R. Alien, London 1953).
ANT Antiquity, a Quarterly Review or Archaeology, founded by the late O. G. S. Crawford.
Ganapati Sastri, TSS. 79, 80, 82. Also, 2nd ed. (text) R. Shama Sastry, Mysore 1924; the same scholar's word index to Arth. (3 vol., Mysore 1925) is indispensable, but his English translation (3rd ed., Mysore 1929) leaves much to be desired. The best available trans lation, though not to be used uncritically, is still that of
J. J. Meyer: "Das altindische Buch vom Welt- und Staatsleben, Das Artha&stra des Kautilya" (Leipzig 1926). cf. also Meyer's " Ueber das Westen der altindischen Rechtsschriften und ihr Verhaltnis zu einander und Kautilya's (Leipzig 1927 : valuable analysis, without an index. The Niar&thl translation of Arth. by J. S. Karandikar and B. R. Hivargfiokar (2 vol. Karjat 1927-9) cannot be recommended.

Bail Jungle Life in India, or the journeys and journals of an Indian geologist, by V. Ball (London 1880).
"Selections from the travels of Ibn Battuta (1325-1354)", trans. H. A.
R. Gibb (London 1929, reprinted 1939; "The Broadway Travellers"). Beal Ta-Tang'Si-Yu^Ki •*. Buddhist records of the western world, trans lated from the Chinese of Hiuen Tsang (A. D. 620) by Samuel Beal; 2nd vol., London 1884 ; the introductory portion contains a translation of Fa Hian's travels, and other documents.
BEFEO Bulletin de l'&cole Francaise de Fextreme Orient.
BI J. Burgess and Bhagwanlal Indraji : Inscriptions from the Cave Temples of Western India (Bombay 1881).
BJ Francis Buchanan : "A Journey from Madras through the countries of Mysore, Canara and Malabar performed under the orders of the Most Noble the Marquis of Wellesley, Governor General of India for the express purpose of investigating the state of Agriculture, Arts, and Commerce, the Religion, Manners and Customs, the History Natural and Civil, and antiquities, in the dominion of the Rajah of Mysore and the countries acquired by the Honourable East India Company in the late and former wars, from Tippoo Sultaun " (3 vol. London 1807; 2nd ed . in 2 vol., Madras 1870)1
B-P. B. H. Baden-Powell : The land-systems of British India (3 vol. Oxford 1892). The work is a handy digest of the Settlement Reports, most of which are not available to the ordinary reader, though the unsubstantiated theorizing about history and races should ignored. The same author's Manual (of the Land Revenue System and Land Tenure of British India, Calcutta 1882) abbreviates the facts without cutting down the theories.
BPL George A. Grierson : Bihar Peasant Life 2nd ed. Patna 1926.
Brough J. Brown : " The early brahmanical system of gotra and pravara" (a translation of the gotra-pravara-manjari of a medieval author, Purusottama). Cambridge, 1952.
BrUp. Brhadaranyaka Upanisad.
BSOAS Bulletin of the School of Oriental and African Studies (of the University of London).
ABBREVIATIONS AND BIBLIOGRAPHY

CAI The Cambridge History of India, vol. I, "Ancient India E. J. Rapson, Cambridge 1922, 1935.
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CII Corpus Inscriptionum Indicarum.
Crooke W. Crooke : "Rural and argicultural glossary for the N. W.
Provinces and Oude (= U.P.)" (Calcutta 1888). Cullavagga
DB "The book of Duarte Barbosa" (1500-1517; from the Portuguese text, Lisbon 1812), trans. M. L. Dames (London 1918, Hakluyt Society no. 44).
DHI Louis de la Vallee Poussin : " Dynasties et histoire de 1'Inde depuis Kanaka jusqu'aux invasions musulmanes " (Paris 1935).
DKA F. E. Pargiter : " The Purana text of the Dynasties of the Kali Age"
(Oxford 1913) ; synoptic text and translation of the historical portion of the puraaias, still standard. For a general critical analysis of the puranas, see R. C. Hazra : " Studies in the Puranic records on Hindu rites and customs ", Dacca, 1940.

DN Digha-Nikaya (Pali Text Society's edition).

A. Shakespeare : " Selections from the Duncan Records" (Benares 1873, 2 vol.). With this should be read the " Selections from the revenue records North West Provinces" (Allahabad 1873).

EC Epigraphia Carnatica, edited and translated by Lewis Rice.

ED H. M. Elliot (ed. J. Dowson) : " The history of India by its own historians; the Muhammadan period" (8 vol. London 1867 +). EI Epigraphia Indica (publication of the Archaeological Dept, for Indian inscriptions). Ent R. Enthoven ; Tribes & Castes of Bombay, 3 vol. (Bombay 1920-22).

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Fick R. Fick : " Die sociale Gliederung im nordostlichen Indien zu Buddhas Zeit mit besonderer Rucksichtigung der Kastenfrage vornehmlich auf Grund der JStaka. dargestellt". (Kiel, 1897).

Fleet J. F. Fleet : " Inscriptions of the early Gupta kings and their successors" (Corpus Inscriptionum Indicarum III, Calcutta 1888). A revision has been announced, but hot yet published, nor the supplementary volume of Satavathana and other epigraphs.

FOM Oriental Memoirs; a narrative of seventeen years residence in India by James Forbes Esq. F.R.S.; 2nd edition revised by his daughter the countess of Montalembert. 2 vol. London 1574. Forbes arrived in Bombay as Writer to the government in 1766 and sailed for home in 1784.

J. Gernet : Less aspects economiques du Bouddhisme duns la societechinoise du V[e] au X* siecle; (Saigon 1956 — vol. 39 of the Publications de 1'ecole franfaise d'extr&ne-orient).

Har. The Harsacaritam of Bana; Sanskrit text, with commentary of Satfikarakavi, Bombay, 7th ed. (Nirnaysdgar) 1946; I have had the still unpublished commentary of Rariganatha (Madras Govt. A/55, collection R. 2703) copied out for my use. The English translation by E. B. Cowell and F. W. Thomas (London 1897, reprinted 1929; Royal Asiatic Society, Oriental Trans. Fund), is useful, as is the (sometimes rather uncritical) analysis and comment in Hindi by V. S. Agrawftla (Harsacarita, eka saqiskjtika adhyayana, Patna 1953).

HOS Harvard Oriental Series (Harvard University Press, Cambridge-Mass. USA).

Hun W. W. Hunter: Annals of Rural Bengal (London 1868). Specially useful for information about the Santal uprising.

IA Indian Antiquity.

IAR Indian Archaeology, a Review; begun 1954*4, with a second number for 1954-5, apparently not for sale to the general public, but a valuable survey of recent archaeological work.

1G Imperial Gazetteer of India (new edition) 26 vol., Oxford 1907-9. With this should be taken the various provincial gazetteers of which little use has been made in this work as they are all sadly out of date, but many of which (e.g. Gazetteer of the Central Provinces of India; ed. Charles Grant, Nagpur 1870) contain valuable information about tribal life of the period.

IHQ Indian Historical Quarterly.

INDIA Annual published since 1953 by the Publications Division of the Ministry of Information & Broadcasting, New Delhi; compiled by its Research and Reference section. This gives the statistics and general information of interest for the whole country.

ITM L. de la Vallee Poussin : "L'Inde aux temps des Mauryas et des barbares, Grecs, Scythes, Parthes et Yue-Tchi" (Paris 1930).

I-tsing trans. J. Takakusu (Oxford, 1896) of I-tsing's Record of the Buddhist Religion as practised by India and the Malay Archi pelago. I-tsing spent 16 years in India, mainly to study monastic life and administration ; of these, ten years circa A.D. 675-685 at Nalanda. JA Journal Asiatique.

JAOS Journal of the American Oriental Society.

JASB Journal of the Asiatic Society of Bengal (three series, the society having once been changed into the 'Royal Asiatic Society', and afterwards merely the 'Asiatic Society*). The numismatic supplements to the middle series are paged separately.

Jat. Pali text in Roman ed. V. Fausbb"!! " The Jataka together with its commentary, being tales of the anterior births of Gotama Buddha": 7 vol. London 1877-97. The English translation by various scholars is far less competent than the

Gennan by Julius Dutoit : " Jatakam — Das Buch der Erzahlungen aus friiheren Existenzen Buddhas" (7 vol. Mttnchen 1906-1921).

t
(Bibliotheca Indica 1516, 1522, 1533). Biihler, SBE 25.
English translation by G.
NDG George A. Grierson : "Notes on the district of Gaya" (Calcutta 1893).
PE
Asoka's Pillar edicts by number, as edited in the Corpus Inscriptionum Indicarum (with English translation) vol. I, new edition by E. Hultzsch (Oxford, 1925).
Raj. Rau
"Kalhana's Rajatarangini, a chronicle of the kings of mir" trans. M. A. Stein, 2 vol. London 1900 ; most useful for its notes, without which the Sanskrit texts edited by Stein, Durga Prasad, and others would be incomprehensible. Stoat und Gesellschaft im alten Indien nach den Brahmanen-Texten dargestcllt von Wilhelm Rau (Wiesbaden, 1957).
RE
Asoka's Rock Edicts by number, text and translation as for PE.
Roy
S. C. Roy : The Mundas and their Country (Calcutta, 1912).
RV
The Rgveda; text with commentary of Sayana, 4 vol., Poona 1933-46. Used therewith, Grassmann's Worterbuck zum RV, and the German translation by A. Ludwig, 6 vol. Prag. 1876-88. K. G. Geldner's German translation (HOS 33-35) is as good as any.
SB.
Satapatha Brahmana ; mostly, from the translation of Julius Eggeling, SBE, 12, 26, 41, 43, 44.
SBE
" Sacred Books of the East ". A series of English translations by various scholars, under the general editorship of F. Max Muller, published at Oxford, mostly in the last twenty ye^rs of the 19th century.
Schoff
W. H. Schoff trans : " Periplus of the Erythraean sea, travel and trade in Indian Ocean by a merchant of the first century'" (New York 1912). The text is from the edition of C. Mullet Geographici Graeci Minores, Paris 1855 and B. Fabricius, Leipzig 1883. SchofFs dating of the original to A. D. 60 may not be acceptable if the king Mambanus, presumably a corrupt reading for Nambanus, is taken as NahapSna, but it would be difficult to date the work beyond A. D. 90. See also W. Me-Crindle, I A. 8, 108-151.
SN
The Suttanipata : most archaic Pfili Buddhist canonical works, ed. Fausholl; his translation in SBE X has been used with emendation.
Strabo
The text and translation of his Geography, particularly the XVth book, by H. L. Jones in the Classics have been consulted.
JBBRAS Journal of the Bombay Branch of the Royal Asiatic Society. JBORS Journal of the Bihar and Orissa Research Society (now only the Bihar Research Society).
JESHO.
JNSl Journal of the Numismatic Society of India.
JOR Journal of Oriental Research, Madras (from the Kuppuswami Sastri Research Institute, Mylapore, Madras).
JRAS Journal of the Royal Asiatic Society of London.
Kern Der Buddhismus und seine Geschichte in Indien; translated into German from the Dutch of Henrik Kern by H. Jacobi; 2 vol. Leipzig 1882, 1884. Treats of the Buddha as a myth, but with good presentation of the canonical source material.
KSS The Kathd-sarit-sagara of Somadeva-bhatta; Sanskrit text, 4th ed. (Nimaysagar) Bombay 1930; the excellent translation by C. H. Tawney, edited with explanatory notes, appendices, and index, by N. M. Penzer as "The Ocean of Story", 10 vol. London 1924 ff. is indispensable for finding anything.
Ludtn H. Ltiders : " List of Brahm! inscriptions from the earliest times to about A. D. 400 with the exception of those of Asoka ", Appendix to EI vol. 10, D. R. Bh&ndarkar's list in El 19-20 revised that of Kielhorn in El 5 and 8 ; both are much less

useful than those of Luders. XXiv

Mahavagga SBE. 13, 17.

MAN A journal for the study of anthropology.

Manned Storia di Mogor (or Mogul India, 1653-1708) by Niccoiao Manucci, Venetian; trans. with introduction and notes by

W. Irvine; 4 vol. (London 1907-8). Mbh. The Mahabharata, for the first time critically edited by Vignu S. Sukhthaajkar (with the cooperation of many others). Ppona 1933; the work is still being carried on, though less com petently after Sukhtharikar's death in 1943. For finding the relevant material quickly, those who (like me) read Sanskrit far more slowly than English would be helped by P. C. Roy's English translation (continuously reprinted since the first edi tion in the 1880's) of the inflated vulgate text.

Meg. J. W. McCrindle : "Ancient India as describe^ by Megasthenes and Arrian " (Calcutta 1926, badly reprinted from IA 1876-77). T he text was published as selections of the quota tions or reports of Megasthenes which survive in Strabo, Diodorus Siculus, and others by E. A. Schwanbeck, Bonn 1846. For Diodoros, I have used the edition by Dindorf and Latin translation of Carl Mttller, Paris 1878.

Montgomery Martin : " The history, antiquities, topography and statistics of EASTERN INDIA, comprising the districts of Behar, Shahabad, Bhagalpoor, Goruckpoor, Dinajpoor, Puraniya, Rungpoor, and Assam, in relation to their geology, mine ralogy, botany, agriculture, commerce, manufactures, fine arts, population, religion, education, statistics &c., surveyed under the orders of the supreme government and collated from the original documents at the E.I. House, with the permission of the honourable court of directors " (3 vol. London 1838). This

-is a trimmed copy of Francis Buchanans reports. The reader would not be able to guess that the original work was by Buchanan. The original reports pertaining to Bihar districts have later been published by the Bihar and Orissa Research Society, under Buchanan's name.

MN Majjhima Nikaya

Mor. W. H. Moreland : (A) " The agrarian system of Moslem India" (Cambridge 1929). (B) "India at the death of Akbar" (London 1920). (C) "From Akbar to Aurangreb " (London 1923).

MP Milindapanho; P&Ii text ed. R. D. VStfekar (Bombay 1940) English translation SBE 35, 36.

Ms. Manusmfti. Sanskrit text with commentary of Kulluka, Bombay (Nirnaysagar, 9th ed.) 1933; with the commentary of Medhttithi, ed. Ganganath Jha, 3 vol. Calcutta 1932-39

Translations quoted here are mostly those by J. W. McCrindle in Meg. and in " Ancient India as described in classical literature " (London 1901), the last of McCrindle's six volumes oi sources in translation. That volume also contains excerpts from Pliny, Kosmas Indikopleustes and others.

Tar. Anton Schiefner : " Tiranathas Geschichte des Buddhismus in Indien aus dem Tibetischen ubersetzt" St. Peterburg 1869. TS. A. B. Keith (Trans.) " Veda of the Black Yajus School", HOS 18-19. TSS Trivandrum Sansknt Series.

Var The itinerary of Ludovico Varthema of Bologna " from 1502 to 1508 ; trans. J. W. Jones, 1863 ; special edition, London 1928.

WIS Indische Studien, ed. A. Weber.

WZKM Wiener Zeitschrift fur dU Kunde des Morgenlandes.

Yule "Cathay and the way thither" by H. Yule, 2nd ed. H. Cordier, 3 vol. London 1913-5 (Hakluyt Society nos. 38, 33, 37).

ZDMG Zeitschrift der Deutschen Morgenlandischen Gesellschaft.

APPENDIX E KOSAMBI'S CHRONOLOGICAL OUTLINE.

Chap. III : Foundation of the Indus cities, circa 3000 B. c., say during the Jemdet-Nasr period in Mesopotamia (cf. fig. 6). Hammurabi's dates are taken as 1728-1686

B.C.

Chap, IV : First Aryan invasion, circa 1750 B.C. Main Rgvedic period about 1500

B.C. Second Aryan wave circa 1100 B.C.

Chap. V : The Yajurveda completed by 800 B. C. Satapatha Bramana by 600 B.

C. not counting occasional later interpolations in each.

Chap. VI : Silver coinage regularly used in Kosala and Magadha by 7th century B, c Death of the Buddha and Pasenadi (both at the age of 80) and about 483 B. c. Mahavira died a few years after Buddha, perhaps about 468 B.c. Bimbisara of Magadha began to rule about 540 B.C., Ajatasatru in 492, Mahapadma Nanda before 350.

Chap. VII : Alexander's invasion of India began late in 327 B. c, retreat from the Befis July 326 B. c.; death in Babylon 323 B. c, Mauryan emperors from Candragupta about 321-184 B.c Asoka. circa 275-232 B.C. The contemporary Yavana kings mentioned in Asokan edicts are : Antio-chos II Theos (Syria, 261-246); Ptolemy Philadelphos (Egypt, 258-247); Antigonos Gonatas (Macedon, 278-242 or 239) ; Magas (Cyrene, d. 258); Alexander of Epirus, about 272-258 B.C.

Chap. VIII : First Satavahanas circa 200 B. c. Rudradaman's Girnar inscription,

A. D. 150 Indian raid of Antiochos III of Syria, 206 B. c. Indo-Greek princes, 200-58 B. c Of these, the house of Euthydemos ruled the Kabul valley, with shifting portions of Bactria and India; Eukatides and his descendants, 165-25 B.C. Saka-Pahlava rule over the Punjab, 75 B.C.

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—A. D. 50. The foundation of the Ku^ana empire by Kaatf§ka started the era of A.

D. 78. The last Kushana emperor Vasudeva ruled about A. D. 200 but the title devaputra of this dynasty (from the Chinese 'Son of Heaven' or possibly from the Iranian) was claimed by some enemies of the Guptas as late as the 4th century, and it is possible that descendants continued to rule at Kabul till the end of the 8th century.

Chap. IX : Gupta era founded A. D. 319-20 by the first emperor Candragupta I; his father Ghatotkaca and grandfather Srigupta were local chieftains, ia the Fyzabad-Prayag region. The major successors took the throne approximately as follows : Samudragupta, A. D. 330; Candragupta II, 380; Kumaragupta I, 415 ; Skandagupta, 455 ; Budhagupta ruled in the north till about 515. The Valabhi dynasty was founded by Bhatarka in 480, and lasted till A. D. 700. The Huns Tormana and Mihiragula held sway over Malawa from about A. D. 500 to 528. Harsa, say A. D. 605-6 to 647. Sar$a's enemy Narendragupta-Sasanka was the last of the northern Guptas. The visit of Fa Hian to India covers 405 ; Hieun Tsang, about A. D. 629-645. The Kadamba king Mayuraiarman is now placed late in the 4th century.

Chap. X : Marco Polo visited south India twice, in A. D. 1288 and 1292-3. The greatest known Chinese flotillas were ted into Indian waters by the Ming admiral Chcng Ho, between the years A. D. 1405 and 1433. The last four voyages went as far as Ormuz and the African coast, (cf. China Reconstructs 5.7, July 1956, pp. 11-14). The first Muslim (Arab) raids seem to have begun from about 637. The steady reduction of territory for permanent Occupation began with Muhammad bin Al-KasimV victory over Dahir in A. D. 712, whereby Multan and the whole of the lower Indus valley was brought under the Muslims. Mahmud of Ghazni (died

A. D. 1030) extinguished in successive raids the Sahiya dynasty of Udabharula (Urid), and the Pratiharas of Kanauj. The Gurjara-Pratihara (Parihara) kingdom was founded about A. D. 725 by one Nagabhata. The second king of this name took Kanauj (which remained the capital) about 810 The dynasty ended with Rajyapala who was killed in

1020, after the defeat by Mahmud. The, Palas of Bihar and west Bengal began with a local chieftain Gopala about 750, and petered out in 1175, though the territory from about 1108 to Muhammad bin Bakhtyar Khalji's raid at the end of the century.   The Candel kings, who started as aboriginal (Goi?) chiefs founded their own kingdom after a defeat of the Pratlhatas in the 9th century and ruled over Bundelkhand (Jejakabhukti) till the end of the 12th century. The Gahatavala (Rathor) kings succeeded to the throne of Kanauj with Candradeva in 1090, and were wiped out in 1194 by Muhammad Ghuri, who had also defeated the Cauhan (Chaunsna) king Prthvi Raja a year or so earlier. In the peninsula,, the Chalukyas began with PulikeSin I at Badamf, about A.D. 550, and were overthrown in 757 by the Rastrakutat, who defeated Kirtivarman. The eatery continued till 1070. when Rajendra m Coja (KulottuAga) united the two

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crowns as descendant of both houses. The first prominent Krgna I, ruled 768-772, the fourth known chief of his line. The line ended in 982. The Calukyas of Kalyani lasted from 696 to 1200. The Pallavas from the fourth century to the late ninth. The Colas from 846 to 1279.

The Muslim ' slave' dynasty of Delhi began with Kutb-ud-din Aibak, slave of Muhammad Ghuri, in 1206, ending in 1290. The Khalji sultanate succeeded, 12901320 (Ala'uddin, 1296-1316) ; Tughluqs, 1320-1413 (Firuz 1351-1388). Sayyids, 14141451; Lodis 1451-1526; Mughals 1526-1858. but shadow emperors after Aurangzeb (1658-1707). The Bahamani dynasty (mostly at Gulbarga) of the Deccan : 1347-1426 ; but in 1518, five separate provincial governors set up independent kingdoms. The most important of these was the Adil-Sahi house of Bijapur, which terminated with defeat of the hands of Aurangzeb in 1686. The Hindu kingdom of Vijayanagar, which was founded in 1336, was destroyed by a confederacy of four of the five Deccan Muslim kingdoms after the battle of Talikota, Jan. 26, 1565, though descendants survived as local chiefs.

(7854 words)

APPENDIX F SOURCES OF SANSKRIT MANUSCRIPTS IN INDIA

Tamilnadu	
Chennai	Govt. Oriental Mss. Library
Chennai	Dr. U.V.S.I. Library
Chennai	Ramakrishna Mission
Thanjavur	TMSSM Library
Chennai	Kingdom of Trivandrum
Kanchipuram	Kingdom of Trivandrum
Kanchipuram	Sri Kanchi Sankar Math
Madurai	Saurashtra Sabha
Chennai	Kupuswami Sastri Res. Institute
Chennai	Adyar Library and Research Centre
Annamalai Nagar	Annamalai University Library
Thanjavur	Tamil University (Dept. of epigraphy)
Thanjavur	Tamil University (Dept. of His. & rare paper Mss.)
Thanjavur	Tamil University (Dept. of Palm leaf Mss.)
Madurai	Govt. Museum

Chennai	**Institute of Asian Studies**
Kanchipuram	**Madurai Province Jesuit Archives**
Shrothium Navalpakkam	**Nyaya Mimamsa Anusandhan Kendra**
Madurai	**Madurai Kamraj University**
Shrotium Navalpakkam	**Sri Hayagriva Mahala Library**
Thanjavur	**Karandai Tamil Samgam**
Mayauram Madurantakam	**Vasudeva Brahmendra Saraswati Library**
	Ahobila Mutt Sanskrit College
Madurai	**The Rameswaram Devasthanam Pathasala**
Kanchi Conjivaram Sriperambudur	**The Upanishad Brahma Mutt**
	The Ubhayavedanta Sanskrit College
Srirangam	**The Srirangam Devasthanam Library**
Chennai	**Fort St. George Museum**
Chennai	**International Institute of Tamil Studies**
Madurai	**School Historical Studies, Madurai Kamaraj University**
Maharashtra	
Nagpur	**Nagpur University Library**
Pune	**Bharata Itihasa Samsodhaka Mandala**

Pune	**Anandashram Sanstha**
Pune	**Bhandarkar Ori. Res. Institute**
Pune	**Vaidika Samsodhan Mandala**
Mumbai	**Jama Masjid Trust Library**
Mumbai	**Asiatic Society**
Mumbai	**Bombay University**
Mumbai	**Maharastra State Archieves**
Kohlapur	**Shivaji Universiry (BARR) Balasaheb Khandekar Library**
Poona	**Poona Universiry, Laykar Library**
Mumbai	**Smt. Nathi Bai Damodar Thakarsey women's University Library**
Nagpur	**Anthropological Survey of India LIbrary (Central)**
Pune	**The Mandalik Library, Fergussion College**
Nasik	**The Hamsaraj Pragji Thakersey College**
Raipur	**Rajpur Sanskrit Pathsala**
Nagpur	**Jamia Arabia Islamia**
Bombay (Colaba)	**Anantacharya Indolofical Research Institute**
Bombay	**Bhartiya Vidya Bhawan**
Bombay	**Bhartiya vidya Bhawan**
Shirur	**Vhandmal Tarachand Bora College**
Beed (Ambajogai)	**Dasopant Samsodhan Mandal**

Pune	Deccan College Post Graduate & Research Institute
Nasik	HPT Arts & RYK Science College
Thane	Institute for Oriental studies
Dhule	IBK Rajwade Samsodhan Mandal
Bombay	KR Cama Oriental Institute
Yavatmal, Arni Road	Shardashram
Amravati	Sri Samrthi Vagdevata Mandir
Dhule	Sri Samarthi Vagdevata Mandir
Mumbai	Asiatic Society of Bombay
Nagpur	The Bhonsala Veda Shastra Mahavidyalaya
Yeotmal	C P andBerar Jain Research Institute
Mumbai	Forbes Gujarati Sabha, Vithalbhai Patel Rd.
Mumbai	Heras Institute of India History and Culture, St. Xavier's college Marathi Samsodhan Mandal, marathi grantha Sangrahalaua, Thakurdwar
Mumbai	

Karnataka	
Hubli	S.J.M.Math
Dharmshala	Jai Basadi Moodbidri
Mangalagangotri	Mangalore University Library
Bangalore	Central Power Research Institute Library

Dharwad	Karnataka Historical Research Society
Melkote	Academy of Sanskrit Research
Moodbidri	Sri Vira Vani Vilasa Jain Sinddhanta Bhawan
Moodbidri	The Danasala Matha Sastra Bhandara
Bangalore	Sri Chamarajendra Sanskrit College Chamrajpeth Sri Siddhanlingeswer Sanskrit Colege and Veda Pathsala, Siddhanganga
Tumkur	
Melkote, Pandavapura	Sanskrit College, Manday
Mysore	The Parakala Mutt Library
Udipi	M G M College
Udipi	Mutt of Sri Madhvacharya Sansthan
Karkala	Jaina Mutt
Udipi	Sri Krishna Mutt
Udipi	The Pejawar Mutt
Mysore	The Palace saraswati Bhandar, Maha. Skt Coll.
Sravanavelagola	Srimaccarukirti Panditacarya Jain Bhandar
Sringeri	The Sharada Pitha. The Mutt H.H. Swami
Sringeri	Sankara Narayana Jyautisika
Bangalore	Kannada Sahitya Parishat
Mysore	Maharaja Sanskrit College

Mysore	**Mysore Sanskrit Academy**
Udupi	**S M S P Sanskrit College**
Melkote	**Vedavedantebodhini Sanskrit College Karnataka University, Dept. of Skt, History (Post graduate teaching)**
Dharwad	
Gulbara	**Institute of Kannada Studies (Gulbara University)**
Dharwad	**Institute of Kanada Studies (University of Karnakta)**
Bangalore	**Bangalore University Library**
Bangalore	**Kalpataru Research Academy**
Dharmasthala	**Sri Manjunatheswar Cultural & Research Institute**
Dharwar	**Vidyadhisha Sanskrit manuscript Library**
Mysore	**Oriental Research Institute**
Bangalore	**United Theological College**
Kerala	
Keladi	**Keladi Museum & H R B**
Trivandrum	**O. R. I & Messs. Library**
Trivandrum	**The state Archieves of Kerala**
Tripunithura	**Sri Ram Verma Govt. Skt. College**
Cochin	**Central Inst. of Fisheries Techno. Library**
Trichur	**Rama Verma Research Institute, Town Hall**

Kasaragod	Edneermath
Kottayam	Kottayam Public Library Manuscript Library (Deptt, of Malayalam) University of Calicut
Calicut	
Calicut	Calicut University Library
Palghat	Chandraprabha Digambara Jain Basti
Thiruvanantapuram	Kerala Granthasala Sandham
Palghat	Palghat educational & Cultural Council

Delhi	
New Delhi	National Archieves
New Delhi	Indian Council of Cultural Relation, Azad Bhawan.
New Delhi	National Museum
Delhi	Delhi Archieves
New Delhi	Delhi University Library
New Delhi	ICSSR, Social Science Documentation Centre
New Delhi	Indian Institute of Islamic Studies Raja Rammohan Roy National Educational Resources Centre
New Delhi	

	Library Sri Ram Centre for Indusrial Relations & Human Resources Library
New Delhi	
Delhi	Mahabir Jain Pustakalaya

Delhi, Timarpur	Bharatiya Vidya Sansthan (Inst. of Indology)
Delhi	Madarsa Aminiya
New Delhi	Dr. Zakir Husain Library (Jamia Milia Islamia)
New Delhi	International Academy of Indian Culture, Haus Khas Enclave
Alipur, Delhi	Bhogilal Lehrchand Research Institute
Delhi	Dargah hazrat Shah Abul Khair
New Delhi, Nizamuddin	Galib Academy

Andhra Pradesh	
Hyderabad	Andhra Pradesh Govt. Oriental Mss. Lib. and Research Institute
Tirupati	Sri Venkateswar oriental REs. Institute
Hyderabad	Salar jung Museum Liberary
Hyderabad	Kutub Khana-I-Saidiya
Hyderabad	Jamia Nirzamia
Hyderabad	Abul Kalam Azad Oriental Res. Institute
Hyderabad	Archival Cell (Dept. of History
Hyderabad	Birla Archaeological and Cultural Res. Inst
Hyderabad	City Central Library
Hyderabad	Osmania University Reginal Library
Rajahmundry	Sri Gowthami Reginal Library

Rajahmundry	Sri Rallabandhi Subbarao Archeological Museum
Vishakhapatanam (Waltair)	Andhra University Library, Dr. V S Krishma Library
Rajahmundry	Andhra Historical Research Society
Vishakjpatanam	Arsha Library
Hyderabad	Oriental Public Bureau and Dairat Ul Maarif
Chitoor	Samskrita Bhasha Pracharini Sabha
Kakinada (Ramraspet)	Telugu Academy
Hyderabad	Sanskrit Academy, Osmania University
Hyderabad	Henery martyn Institute of Islamic Studies
Hyderabad	The state Archieves of Andhrapradesh
Bhattanavalli	The sanskrit press and Publications
Aukiripalli, Krishna	Sri Markandeya Sanskrit College
Guntur	Sri Sharada Niketanam
Vijayanagaram	Maharaja's Govt. Sanskrit College
Nellore	Veda and Sanskrit College
Tirumala	T T D Veda Pathashala
Vetapalem	Saraswata Niketan
Vizianagaram	The Vizianagaram Fort

APPENDIX G ASTRONOMICAL OBSERVATORIES IN INDIA

The following astronomical observatories have varying quantities of manuscripts related to ancient astronomy in India
Source http://www.cs.utexas.edu/users/mitra/astro.html

Observational Astronomy through the ages in India

STONE OBSERVATORIES OF JAI SINGH

Sawai Jai Singh (1686-1743) constructed five observatories in India at Delhi, Jaipur, Benaras, Ujjain, and Mathura. The one in Mathura no longer exists. The observatories in Benaras and Ujjain are in a state of disrepair. In these observatories Jai Singh installed astronomical instruments of pre-telescopic era. Some of the instruments were made out of metal but most were constructed of masonry. Many of the instruments were Jai Singh's own invention such as Jai Prakasa Yantra, Rama Yantra, and Samrat Yantra. Jai Singh was aware of the existence of telescopes but the ones that come into his hands were poor in quality, suffering from defects like spherical and chromatic aberrations. He opted for instruments made out of stone and masonry. Jai Singh produced a set of astronomical tables completed sometime between 1727 and 1735. The tables were called ZIJ-I MUHAMMAD SHAHI - the astronomical tables of Muhammad Shah, the reigning monarch at that time.

THE OLD MADRAS OBSERVATORY

was established by the East India Company in 1792. The guiding force behind the construction of this observatory was Michael Topping a sailor-astronomer. He acquired several astronomical instruments, some from William Petrie a noted English astronomer. Among the instruments that he had were achromatic refractors, astronomical clocks with compound pendulum, and an excellent transit instrument. The observing program included stars, the Moon, and eclipses of Jupiter's satellites. For more than a century measurements of stellar positions and brightnesses were made. During this period several Government astronomers headed the observatory. Notable among them were Goldingham, Taylor, Jacob, and Pogson. The last astronomer was well known for the Pogson's scale in photometric work. At the end of the nineteenth century the Kodaikanal observatory was constructed which subsumed the role of the Madras observatory. From then onwards the Madras observatory had a side role in weather forecasting and time service.

CALCUTTA

A small observatory was established in Calcutta by the East India Company around 1825 to serve the Survey Department. It had a transit telescope, alti-azimuth circle and later an astronomical telescope was added. Some astronomical observations were performed of lunar transits and eclipses of Jupiter's satellites, but mostly it was confined to routine time recording and meterological observations.

LUCKNOW

King Nasiruddin Haydar, who reigned in Oudh, established an observatory in Lucknow during 1832. According to some reports it was one of the best equipped observatories in India at that time. It had a mural circle, a transit telescope, an equatorial telescope, and astronomical clocks. Maj. Richard Wilcox was in charge of the observing program. Wilcox and his assistants observed the major planets, the larger asteroids like Ceres and Vesta, eclipses of Jupiter's satellites, occultations of stars by the Moon, and meridonial transit of stars. After Wilcox's death the observatory was closed due to political reasons and was destroyed during the Indian War of Independence in 1857.

THIRUVANANTHAPURAM

In 1836, the Raja of Travancore had an observatory built in Trivandrum. He appointed John Caldecott as its director. For the observatory, Caldecott acquired a transit instrument, two mural circles, an equatorial telescope, and magnetic and meteorological instruments. He collected an enormous amount of astronomical data, which included the observations and computations of the orbital elements of the comets of 1843 and 1845. After Caldecott's death the next notable director was John Broun. But Broun's interest was mainly in meteorology and terrestrial magnetism. Broun is associated with the discovery of the relationship between solar activity and subsequent changes in terrestrial magnetism. After Broun's departure in 1865 the observatory was closed by the then Raja of Travancore.

PUNE

Owing to the efforts of a Parsi physicist, K. D. Naegamvala, an observatory was established in Pune around 1882 through a grant from the Maharaja of Bhavnagar. The observatory had a 20-inch Grubb reflector for both visual and photographic work, spectroscopes, and sidereal clocks. It was a premier spectroscopic observatory in India. Naegamvala made spectroscopic

observations of the solar chromosphere and corona during the solar eclipse of 1898. He also made spectroscopic studies of the Orion nebula and sunspot groups. After Naegamvala's retirement in 1912 the observatory was dismantled and the instruments were transferred to the fledgling observatory in Kodaikanal.

CALCUTTA

In 1875, Father Lafont established a spectroscopic laboratory in St. Xavier's College, Calcutta in order to carry out solar and stellar spectroscopic work. The observatory had equatorial telescopes, transit instruments, and spectroscopes. Observations of solar prominences were carried out regularly. Later the focus of the observatory was shifted to meteorological work. Currently, the observatory is being used only for teaching purposes.

Mention must also be made of the observatory in Presidency College, Calcutta. It was constructed in 1900 through a grant from the Maharaja of Tipperah who donated a 4.5-inch Grubb reflector. In 1922 it received as a gift from the Astronomical Society of India an 8-inch telescope.

INDIAN ASTRONOMY IN THE EARLY 20TH CENTURY

After the Madras famine of 1886-87, an inquiry commission appointed by the Government recommended that the relation between sunspot activity and the distribution of rains be studied. The site for a solar observatory was selected in Kodaikanal and the observatory started functioning from 1900. Observations of sunspots, solar prominences, and solar photography were carried out on a regular basis from the following year. Spectroscopic instruments were acquired to obtain the spectra of sunspots and spectro-heliographs of the sun in the lines of ionized calcium and hydrogen. The Kodaikanal and Madras Observatory had the same director. Over the years the role of the Madras Observatory was confined to the measurement of time, but the observations of the sun still continue at the Kodaikanal Observatory.
John Evershed became the director of the Kodaikanal Observatory in 1911. He started a program of photographing solar prominences and sunspot spectra. He noticed that many of the Fraunhofer lines in the sunspot spectra were shifted to the red. He showed that these shifts were Doppler. This discovery came to be known as the Evershed effect. From the nature of the sunspot spectra Evershed concluded that they were similar to stars of spectral type K.
Another discovery of Evershed bears mentioning. While comparing the spectra of the limb of the sun with that obtained from the center of the disk he noticed a shift towards the red at the limb. He first attributed that to motion but when Einstein's gravitational displacement was considered to be a factor, Evershed recomputed his results. His conclusion was that while Einstein's gravitational displacement could account for most of the shift, there still remained a definite unexplained residual shift.

HYDERABAD

A wealthy nobleman in Hyderabad acquired a 15-inch Grubb refractor and established an observatory at Begumpet, Hyderabad. The observatory was taken over by the Nizam's Government in 1908 and it soon became involved in an international program of mapping the sky. In this carte-du-ciel program 18 observatories with similar instruments took part. For this program an 8-inch astrograph was acquired. The observatory was alloted the zone between declinations -17° to -23°. Later it also covered the zone between declinations +39° to +36°,

originally given to Potsdam. The observations were carried out under 3 directors - Chatwood, Pocock, and Bhaskaran. Twelve catalogues containing 800,000 stars were published.
T. P. Bhaskaran also started an observing program of variable stars with the 15-inch Grubb telescope. It was during his time that control of the observatory passed from the Nizam's Government to Osmania University. Akbar Ali succedeed Bhaskaran in 1944. Ali started a program of double star measurement. He felt the need to introduce the new study of photoelectric photometry and placed an order for a 48-inch telescope for the observatory.

In the first half of the twentieth century most of the observational work was being conducted at Kodiakanal and Nizamiah Observatories. Much of the theoretical work was being done at three centers - Calcutta University, Allahabad University, and Benaras Hindu University.
At Calcutta University, Prof. C. V. Raman attracted a bright group of young physicists. Among them was M. N. Saha. Saha's greatest contribution was in the theory of thermal ionization and its application to stellar atmospheres. Saha moved to Allahabad University and started a strong group on theoretical astrophysics. Several members of this group made important contributions in the field of stellar interiors. Another group inspired by V. V. Narlikar worked on cosmology at the Benaras Hindu University. His son J. V. Narlikar carried on this line of research.
Post Independence Optical Astronomy in India

The main centers for optical astronomy in India are

Indian Institute of Astrophysics at Bangalore,

Center for Advanced Study in Astronomy at Osmania University,

Uttar Pradesh State Observatory at Naini Tal, and

Physical Research Laboratory at Ahmedabad.

KODAIKANAL

In 1971 the old Madras and Kodaikanal Observatory were made into a single autonomous research institution. The solar observations continued to be performed at Kodaikanal. New instruments had been added over the years - a large solar telescope with a high dispersion spectrograph, a coronagraph, and a monochromatic heliograph. The solar telescope now has a photoelectric magnetograph to make fine measurements of magnetic and velocity fields in the sun. This observatory has sent out several expeditions to observe solar eclipses.
Optical observations of stars and galaxies are conducted from Kavalur in Tamil Nadu. The 20-

inch Grubb reflector that was acquired from the Maharaja Takhtasingji Observatory was tranferred from Kodaikanal to Kavalur. After Bappu became the director a 30-inch reflector was added to the observatory for photoelectric photometry. During Bappu's directorship a 2.3 meter telescope was designed and fabricated indigeneously. This telescope is used at prime (f/3.25) and cassegrain (f/13) focii for imaging and medium resolution spectroscopy using CCD detectors. There is also a 1-meter Carl Zeiss telescope used for CCD imaging and low resolution spectroscopy.

HYDERABAD

The Nizamiah Observatory, which had 15-inch refractor and a 8-inch astrograph, was under the administration of Osmania University. In 1959 a separate teaching department was started. In 1964 the University Grants Commission recognized the department and its observing facilities as a Centre for Advanced Study in Astronomy. A 48-inch telescope was commissioned in 1968 and installed near the villages of Japal and Rangapur. The center under the directorship of K. D. Abhyankar had an active program in photoelectric photometry and spectroscopic observations of variable stars.

NAINITAL

The government of Uttar Pradesh established an observatory in 1954 at Benaras. It was later shifted to Naini Tal when Vainu Bappu was its Chief Astronomer. Singhal, who succeded Bappu, acquired a 1-meter Zeiss telescope. The observatory also has a 15 inch and a 20-inch reflector with folded Cassegrain and Coude foci for solar work. The observing program includes photoelectric photometry of variable stars, comets, and occultation work. In 1977, during the occultation of SAO158687 by Uranus, observers at Naini Tal detected the ring system around this planet.



The 50-year old State Observatory at Nainital was reincarnated on 22nd March 2004 as ARIES, an acronym given for Aryabhatta Research Institute of Observational-SciencES, an autonomous institute under the Department of Science and Technology, Govt. of India. Historically. The Observatory came into existence at Varanasi on 20th April, 1954. The Observatory was later moved from the dust and haze of the plains to more transparent skies of Nainital in 1955, and to its present location in 1961 at an altitude of 1951m at Manora peak, a few km south of the Nainital town.

MOUNT ABU

There is a 48-inch telescope at Gurushikhar on Mt. Abu. The telescope is operated by the Physical Research Laboratory and is used mainly for infrared work. They have a 256 x 256 pixel HgCd array detector for 2 micron imaging. The observing program includes spectroscopy and polarimetry. PRL also has a solar observatory in Udaipur. It has a 12-ft solar telescope on a small island in the midst of Fateh Sagar Lake. The observatory is involved in high resolution chromospheric and photospheric studies of flares.

(2947 words)

APPENDIX H RESOURCES FOR SANSKRIT MANUSCRIPTS OUTSIDE INDIA

Catalogue of the Sanskrit manuscripts in the British Museum.
Bendall, C.
London, 1902.

Catalogue of Sanskrit and Prakrit manuscripts in the British Museum vol. II.
Losty, J.
Unpublished typescript. Classed inventory Manuscript register in 2 vols kept in OIOC Reading Room at Or Gen MSS 15

Catalogue of the Sanskrit and Prakrit manuscripts in the Library of the India Office.
Eggeling, J., Keith, AB, and Thomas, FW.
London, 1887-1935.
2 vols.

Catalogue of two collections of Sanskrit manuscripts preserved in the India Office Library.
Tawney, CH, and Thomas, FW.
London, 1903.

Catalogue of the Nevill Collection.
Nevill, H.

Unpublished manuscript. 4 vols.
List of Pali, Sinhalese, S
Barnett, L.D.
1909.

Unpublished manuscript.
Catalogue of the Hugh Nevill Collection of Sinhalese manuscripts in the British Library.
Somadasa, K.D.
London, 1987-95.
7 vols.

Catalogue of the Pall printed books In the India Office Library.
Raper, T.C.H., ed., and O'Keefe, M.J.C., rev.
London, 1983.

Ancient Buddhist Scrolls from Gandhara: the British Library Kharosthl fragments.
anskrit and other manuscripts,
formerly In the possession of Hugh Nevill Esq. Salomon, R.
LondoniSeattle, 1999.
Preliminary list of manuscripts in languages of Central Asia and Sanskrit, from the collections made by Sir Marc Aurel Stein, KCIE.
Barnett, L.D.
Unpublished typescript (n,d,).

Indian charters on copper plates.
Gaur, A.
London, 1975.

Catalogue of Sanskrit, Pali and Prakrit Printed Books in the British Museum.
Haas, E., Bendall, C., and Barnett, L.D.
London, 1876-1928.
4 vols.

Catalogue of the Library of the India Office. *vol. 2, part 1: Sanskrit books.*
Natha, P., Chaudhuri, J.B. and Na pier, C.F.
London, 1938-57.

4 vols.
Bibliography of *South Asian periodicals: a union-list* of *periodicals in South Asian languages.*
Shaw, G.W. and Quraishi, S.
Brighton, 1982.

Listing of *http://www.columbia.edu/cu/lweb/indiv/southasia/cuvl/LIBS.htm*

Bodlean Library , Oxford

British Library Oriental & India Office Collections Has one of the largest collections of Sanskrit texts outside of India

The École francaise d'Extréme-Orient (EFEO) is a French institute dedicated to the study of Asian societies. Translated into English, it approximately means the French School of the Far East. It was founded in 1900 to study the civilization of Saigon (now Ho Chi Minh City) in what was then French Indochina, with a branch in Pondicherrym India. It's headquarters are now in Paris. Its main fields of research are archaeology and the study of modern Asian societies. The School has a branch in Pondichery.
École française d'Extrême-Orient
22, avenue du Président Wilson
75116 PARIS
tél. 01 53.70.18.60
fax 0 1.53.70.87.60
They have a webs ite http://www.efeo.fr/contacts/paris.shtml

About the India Office Records **g**
Search the British Library's integrated online catalogue
Search OIOC's 19th Century Indian holdings (via DSAL)

Cambridge University Centre of South Asian Studies
About the CSAS library
About the Cambridge University Library Oriental Collections
Search the Cambridge University Library online catalog (Newton)

Cleveland Public Library
About the John G. White Collection of Orientalia (extensive Indic holdings)
Search the CPL/ClevNet Online Catalog

Columbia University
About the South Asia collections
Search CLIO (Columbia's online catalog)
Current Information Sources (at Lehman Library, Columbia)

COPAC
(a union catalog of British Research Libraries, including Cambridge Univ., Edinburgh Univ., Glasgow Univ., Leeds Univ., and Oxford Univ.)
Cornell University
About Cornell's South Asia collections
Search the Cornell University online catalog (fullfeatured web-catalog)

Harvard
Search Harvard's HOLLIS (Harvard OnLine Library Information System)
Leiden University (Netherlands)
Search the Leiden online catalog
Library of Congress, Southern Asia Section
About the Library of Congress Southern Asia Section
About the Library of Congress Asian Reading Room South Asia collection

Search Library of Congress Online Catalog
LC Field Office New Delhi

National Archives of India
NAI home page
User's Guide to the National Archives of India (Richard White, Univ. of Wales, via H-ASIA)
National Library of Australia
About Australia's national South Asia Collections
Search NLA's online catalog

National Library of Bhutan
National Library of Scotland

India Papers collection
Medical History of British India

New York Public Library
About NYPL's Oriental Division and its South Asia Collections
Search NYPL's CATNYP (online catalog)

Oxford University
About the Indian Institute Library (of the Bodleian Library)
Search Oxford's OLIS (online catalog)

School of Oriental & African Studies - SOAS (University of London)
About SOAS' South Asia Collections
Search SOAS' online catalog (web)
Search SOAS' online catalog (telnet)

-at the username prompt, type: **library**
South Asia Resources Database: The Australian Union Catalogue of South Asian Library Resources (via Curtin University) (About 250,000 indexed bibliographic records from two files: main file of South Asia holdings in Australian libraries, and MARC records from National Library of Australia which don't have Australian locations. Site includes simple search as well as advanced boolean searching capabilities.)
SVK: Sundarayya Vignana Kendram (Hyderabad, India)

ABOUT Sundarayya Vignana Kendram and its libraries
SEARCH the catalog of the Urdu Research Library Collection housed at SVK

University of British Columbia
Search UBC's online catalog (web access)
Search UBC's online catalog (telnet access)

University of California - Berkeley
About UC Berkeley's South Asia Collections

Search UC Berkeley's PATHFINDER (online catalog)

University of Chicago
Homepage of UC Library's South Asia section
Search University of Chicago's online catalog

University of Groningen (Netherlands)
Search the University Library's online catalog
-at the username prompt, type: **OPC**
to get to English menus, type: **ENG**
to select the catalogues, type: **X**

University of Hawai at Manoa
About University of Hawaii's South Asia collections
Search University of Hawaii's online catalog

University of Heidelberg - South Asia Institute Library
About the Institute's South Asia Special Subject collections
Search University of Heidelberg's Library catalogue

University of Michigan Libraries
About University of Michigan's South Asia collections
Search University of Michigan's MIRLYN (online catalog)

University of Minnesota, Ames Library of South Asia
About the Ames Library of South Asia and its collections
Search University of Minnesota Ames collection (online catalog)

University of Pennsylvania
About Penn Library's South Asia section and its collections
Search University of Pennsylvania's FRANKLIN (online catalog)

University of Texas, Austin
About University of Texas Asian Studies collections
Search University of Texas UTNetCat (online catalog)

University of Toronto
Search University of Toronto's online catalog (web access)
Search University of Toronto's online catalog (telnet access)

-at the username prompt, type: **UTLINK**
-then hit the return key twice

University of Virginia
About University of Virginia's South Asia collections

Search University of Virginia's online library catalog

at the login prompt, type: **virgo**
at the terminal selection menu, choose **22** for vt100

University of Washington
Homepage of the UW Library's South Asia Section
About University of Washington's South Asia collections
Search University of Washington's online catalog

University of Wisconsin - Madison
About University of Wisconsin's South Asia collections
Search University of Wisconsin's MadCat (online catalog)

The Wellcome Library, London
About the library's collections (incl. oriental holdings & special collections)
About the library's South Asian Iconographic Collections
About the library's Oriental Manuscripts & Printed Books
Search the Wellcome Library's online catalog

APPENDIX I PROPOSED CHRONOLOGY

LEGEND	INDIVIDUAL OR DETAILED DESCRIPTION	DATE
GEOLOGIC EVENT	END OF GLACIATION	10,000 BCE
GEOLOGIC EVENT. WE ARE IN THE WARMING HALF CYCLE BETWEEN GLACIAL ERAS	MELTING OF GLACIERS. THERE ARE BELIEVED TO BE VARIOUS CYCLES, SHORTEST BEING 40,000 YEARS	
GEOLOGICAL EVENT	FORMATION OF RIVER VALLEY CIVILIZATIONS	8000 BCE
ERA. THE BEGINNING OF RECORDED HISTORY IN ORAL TRADITIONS. (SRAUTIC PARAMPARA)	THE VEDIC ERA. THE TEN MANDALAS OF THE RIG WERE COMPOSED OVER A PERIOD OF 500 YEARS	7000 TO 4000 BCE
ERA SARASVATI SINDHU CIVILIZATION	MEHRGARH CULTURE, EARLY PHASE	7000 BCE
WAR	DASARAJNA WAR, THE BATTLE OF THE TEN KINGS	7000 BCE
DYNASTY	THE IKSHVAKUS AND THE RAMAYANA	6000 BCE
ERA , PARADIGM SHIFT, A PHENOMENAL EFFLORESCENCE OF KNOWLEDGE, THE VEDIC EPISTEME	BRAHMANA ERA, BEGINNING OF	5000 BCE
ERA	PURANIC ERA	5000 BCE – 3000 BCE
BIRTH	VEDA VYAASA	3200~3300 BCE
OBSERVATION VERNAL EQUINOX IN ROHINI	OBSERVATION OF NAKSHATRA IN WHICH THE VERNAL EQUINOX OCCURS	~3100 BCE
WAR	THE GREAT BHARATA WAR	NOV 22, 3067 BCE (3102 +-35 BCE –ERROR CAUSED BY CHANGES IN JULIAN CALENDAR)
PARADIGM SHIFT TO LIKHIT PARAMPARA	ERA OF THE SULVA SUTRAS. SUTRAS OF THE CORD, DEVELOPMENT OF GEOMETRY, TRIGONOMETRY	4000 ~2000 BCE
BIRTH	APASTAMBHA	~3000 BCE

BIRTH	BAUDHAYANA	~3200 BCE
ERA	KALI YUGA	3102 BCE
DEATH	SRI KRISHNA NIRVANA	3102 CE
WRITINGS , SCRIPTS HAD COALESCED INTO CODIFIED SYMBOLS	PINGALA	2900 BCE
WRITINGS	PANINI'S ASHTADHYAYI, CODIFICATION OF VYAKARANA AND OTHER VEDANGAS	2900 BCE
PARADIGM SHIFT	USE OF DECIMAL PLACE VALUE SYSTEM (PANINI, PINGALA). CATALYZED INDIC CONTRIBUTIONS TO ALGEBRA, NUMBER THEORY, INFINITE SERIES, SPHERICAL TRIGONOMETRY	2900 BCE
ERA SARASVATI SINDHU CIVILIZATION	MATURE PHASE	3000 BCE – 1700 BCE
DYNASTY (MAGADHA)	BRHIHADRATHA DYNASTY (22 KINGS, 1006 YEARS)	3138 BCE-2132 BCE
BIRTH	ARYABHATA	2765 BCE ,337 YUGABDA
WRITINGS	YAJNAVALKYA, BRIHAT-ARANYAKA UPANISHAD, SATPATHA BRAHMANA	~3000 BCE ASTRONOMICAL EVIDENCE
WRITINGS	ARYABHATA WROTE THE ARYABHATIYUM WHEN HE WAS 23 YEARS OLD	2742 BCE
DYNASTY	PRADHYOTA DYNASTY (5 KINGS, 138 YEARS)	2132 TO 1994 BCE
DYNASTY	SISUNAGA DYNASTY (10 KINGS ,360 YEARS)	1994-1634 BCE
LIFESPAN	GAUTAMA BUDDHA	1887-1807 BCE PURANIC AND ASTRONOMICAL EVIDENCE
BIRTH	MAHAVEERA	1862 BCE
DYNASTY	NANDA DYNASTY (MAHAPADMANANDA AND HIS SONS)	1634 – 1534 BCE
CORONATION	CHANDRAGUPTA MAURYA	1534 BCE -1500 BCE
CORONATION	ASOKA MAURYA	1472 BCE
DYNASTY	MAURYA (12 KINGS ,316 YEARS	1534-1218 BCE
DYNASTY	KUSHAN EMPIRE	1298 BCE

CORONATION	ASHOKA GONANDA	1448 BCE
CORONATION	KANISHKA	1298 BCE
DYNASTY	SUNGA DYNASTY (10 KINGS, 300 YEARS)	1218 – 918 BCE
WRITINGS	PATANJALI'S MAHABHASHYA	1218 BCE
WRITINGS	NAGARJUNA	1294 BCE
REIGN	KANISHKA	1298-1237 BCE
WRITINGS	KALIDASA I	1158 BCE
DYNASTY	KANVA DYNASTY (4 KINGS,85 YEARS)	918-833 BCE
ERA	ANDHRA SATAVAHANA (32 KINGS , 506 YEARS)	833 BCE -327 BCE
BIRTH	KUMARILA BHATTA (MIMAMSA)	557 BCE
ERA	SAKANRIPA KALA (ERA OF CYRUS THE GREAT OF PERSIA	550 BCE
BIRTH	ADI SANKARACHARYA (HAS AN AUDIENCE WITH HALA SATAVAHANA)	509 BCE-477 BCE
HARSHA VIKRAMADITYA		
CORONATION	ALEXANDER OF MACEDONIA	336 BCE
CORONATION	CHANDRAGUPTA OF GUPTA DYNASTY	327 BCE
WAR	ALEXANDER INITIATES AN INCONCLUSIVE BATTLE WITH PURUSHOTTAM, REGIONAL KSHATRAP IN THE PUNJAB AND IS FORCED TO RETREAT SHORT OF HIS GOAL OF VANQUISHING THE GREAT EMPIRE OF INDIA	326 BCE
DYNASTY	IMPERIAL GUPTA DYNASTY (7 KINGS, 245 YEARS)	327 BCE-82 BCE
CORONATION	CHANDRAGUPTA	327 BCE
CORONATION	SAMUDRAGUPTA	320 BCE
WRITINGS	VARAHAMIHIRA PANCHA SIDDHANTA	123 BCE
REIGN	VIKRAMADITYA	102 BCE TO 78 BCE
ERA	VIKRAMA SAKA NAMED AFTER VIKRAMADITYA	57 BCE

WRITINGS	KALIDASA II,AUTHOR OF RAGHUVAMSA ,JYOTIRVIDABHARANA	57 BCE
BIRTH	BRAHMAGUPTA	30 BCE
ERA	SALIVAHANA CALENDAR(PUNWAR DYNASTY)	78 CE
WRITINGS	BHASKARA II,AKA BHASKARACHARYA SIDDHANTA SIROMANI	486 CE
DYNASTY	PUNWAR DYNASTY (23 KINGS,1111 YEARS)	82 BCE-1193 CE
ERA	CHRISTIAN ERA	0 (YUGABDA 3102)
ERA	SALIVAHANA (SAKA CALENDAR)	78 CE
WRITINGS	HUEN-TSANG	625 CE
WRITINGS	KALIDASA III (LIVED IN BHOJA'S TIME	638 CE
DYNASTY	PALA EMPIRE	750-1174 CE
CORONATION	BHOJA RAJA'S CORONATION	648 CE
CORONATION	SRIHARSHA SAILADITYA	648 CE
DYNASTY	CHOLA EMPIRE	848 CE – 1279 CE
BEGINNING OF ISLAMIC ERA	PRITHVIRAJ CHAMAHANA THE LAST MAJOR INDIC DYNASTY IN NORTH INDIA	1192 CE
ERA	DELHI SULTANATE	1192 CE – 1526 CE
ERA	THE HOYSALAS	1040 CE–1346 CE
RECONQUISTA BEGINS AND THE FALL OF TOLEDO	TOLEDO, THE GREAT MUSLIM CENTER OF LEARNING FALLS INTO CHRISTIAN HANDS	1085 CE
ERA	THE KAKATIYAS	1083 CE–1323 CE
INDIA'S FIRST MODERN HISTORIAN	KALHANA (KASHMIRI HISTORIAN)	1,148 CE
ERA	BAHMANI CONFEDERATION	1390 CE -1596 CE
ERA	VIJAYANAGAR EMPIRE	1339 CE -1625 CE
ERA	THE MUGHAL EMPIRE	1526 CE – 1757 CE
DYNASTY	THE MARATHA CONFEDERACY	1674 CE – 1818 CE

DYNASTY	**THE SIKH CONFEDERACY**	**1716 CE – 1849 CE**
DYNASTY	**THE BRITISH EMPIRE, THE BRITISH ROYALTY WERE MOSTLY OF GERMAN ANCESTRY**	**1757 CE – 1947 CE**
ERA	**THE MODERN REPUBLIC**	**1950 CE**